SCIENCE

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RESULTS OF THE BERING SEA CONFERENCES.

THE Fur-Seal Conferences recently held at Washington by representatives of the governments of Great Britain, Russia, Japan and the United States are noteworthy in several respects. The high character and fitness of the delegates, the rapidity with which the negotiations were carried to a successful conclusion, and the essential agreement reached on the principal points under discussion, are matters for international congratulation. It will be remembered that Great Britain declined to take part in a joint conference in which Russia and Japan were to be represented. This led to the holding of two distinct conferences—the first with Russia and Japan; the second with Great Britain and Canada. In the first there were few if any points of dispute, and an agreement was promptly reached whereby the governments of the United States, Russia and Japan pledged themselves to desist from pelagic sealing for a period of one year, pending subsequent negotiations.

In the second conference the conditions were entirely different, the matters under discussion between Great Britain and the

United States having been the subject of international controversy for a number of years. It will be remembered that both countries have been represented at the Pribilof Islands by experts during the past seven years, and that the members of the original Bering Sea Commission of 1891 (Professor T. C. Mendenhall and Dr. C. Hart Merriam for the United States; Sir George Baden Powell and Dr. George M. Dawson for Great Britain) failed to agree on the facts of seal life at the islands. It will be remembered also that in subsequent years the reports of the experts representing the two countries differed materially as to the condition of the rookeries and habits of the seals. These facts, in connection with the hostile attitude of the press of the contending countries and the anxiety over the outcome felt by both governments, give to the findings of the conference an interest and importance quite out of proportion to the real weight of the points at issue.

Great Britain was represented by Professor D'Arcy W. Thompson, of Dundee; Canada, by Mr. James M. Macoun, of the Canadian Geological Survey; the United States, by Dr. David Starr Jordan, President of Stanford University, and the Honorable Charles S. Hamlin, formerly Assistant Secretary of the Treasury. The conference was notable for its brief duration (the sittings occupying only seven days) and for the essential accord of the scientific experts respecting the numbers, condition and habits of the fur seals.

The case was one where naturalists of reputation, who had personally studied the fur seals at the islands, were called upon to make a joint report on matters that had been in controversy for many years, that had led to strained relations between the governments concerned, and respecting which diverse opinions prevailed among the people and the press. The important fact must not be overlooked that the people and the press of Great Britain and Canada have not up to the present time understood the real facts in the case, and that in combating the attitude of the United States they have done so largely through misinformation. It is important to bear in mind, therefore, that the British and Canadian experts in signing the joint report are liable to incur the displeasure of their countrymen, who may regard the report as a concession to the United States. The greatest credit is due them for making a straightforward statement of fact, irrespective of public prejudice.

The delegates had no power to recommend remedial legislation, their duty being to submit a joint report on the facts on which they could agree as to the condition and habits of the fur seals. With these facts before them, it is hoped that the two governments will find little difficulty in framing measures necessary for the permanent protection and preservation of the seal herd. That such measures involve the ultimate cessation or limitation of pelagic sealing is a fair inference from the report of the expert delegates. That Canada, having no rookeries of her own and consequently no opportunity to profit by the sealing industry except as carried on in the open sea, will voluntarily relinquish pelagic sealing without some offset or concession on our part, can hardly be expected. The

friendly attitude of the two governments as shown by recent events leads to the hope that the whole matter may be amicably adjusted. In any event, the complete agreement of the naturalists taking part in the conference may be regarded as a triumph for science.

The essential features of the propositions agreed upon are as follows :

That since 1884 the Pribilof herd has declined from year to year until at present the number of seals is not more than one-fifth to one-third as great as formerly, although the number of breeding females in 1896 and 1897 was between 160,000 and 130,000. It is also agreed that there has been a notable decrease since 1896, although the exact amount of this loss could not be determined. The existence of a high death rate among the young from natural causes is acknowledged and the conclusion reached that not more than one-half or one-third reach the age of three years.

To those who are acquainted with the various reports on the subject the latter figure will seem nearest the mark, and the evident inference would be that if the death rate in nature is so great any addition to it by such causes as pelagic sealing, with the consequent starvation of thousands of young, is bound to reduce the seal herd. The methods of driving and killing as practised on the islands, it is stated, call for no comment, and it is admitted that land killing as now carried on does no harm.

This is one of the points on which the press of both England and the United States has been more or less confused and, in spite of all that has been written on the fur seal during the past few years, there seems to be a vague suspicion that after all land killing may have had something to do with the decrease of the herd. This matter was fully discussed in the preliminary report of 1896, where it was very clearly shown that as the fur seal is polygamous and the harems even now, when the number of females has been greatly reduced, contained on an average thirty females to one male, it is evident that, the birth rate being equal, there is a vast superfluity of males.

It is acknowledged that the catch at sea contains a marked excess of females, and this is a most gratifying admission to those who have read the statements made by the sealers, in which the number of males taken was frequently reported to be as great as that of the females and sometimes even greater, a remarkable state of affairs when it is remembered that, owing to the killing of young males on land and the fact that the nursing females are compelled to go to sea in search of food at a time when the males are on shore, the females are bound to be greatly in the majority.

On the other hand, it is pointed out that not all these females are nursing or pregnant, for the reason that many adult seals have lost their pups through the natural causes, while a certain percentage is bound to consist of yearling and two-year-old females.

The conclusion that excessive pelagic sealing has lead to a decrease in the herd is coupled with the axiomatic statement that a small number of females, less than the annual increment of breeders, might be taken without producing actual decrease.

As this annual increment is at the best small and as for ten years there has been a steady loss, it seems apparent enough that the number that might be taken with safety has been very much exceeded.

It is conceded that pelagic sealing has of late fallen off in a greater ratio than the herd, thus producing a tendency toward equilibrium in numbers. This simply means that over 60,000 seals were taken in 1895; 43,000 in 1896, and 26,000 in 1897, so that the pelagic catch has fallen off one-half in three years, although the herd has not diminished by one-half in the same time.

It is to be feared that before any equilibrium could be reached but a small portion of even the present number would be left, and this leads naturally to the next point agreed upon, which is that in estimating the future conditions of the herd the reduction in the number of pups caused by the pelagic catches of 1894 and 1895 must be taken into consideration.

For example, not less than 20,000 pups, half of them females, perished of starvation in 1895, owing to the death of their mothers from pelagic sealing. Not only did the portion of this number that would have survived fail to appear on the rookeries in 1897, but the number of births will be naturally lessened by just that number in 1898 and the progeny of these in turn fail to appear in 1900. Thus, as the natural decrease will go on, while the natural increase has been cut off, effects of pelagic sealing will be felt up to 1900, even should it be stopped at once.

The final conclusion is that the herd is not in danger of actual extermination so long as its haunts on land are protected and the protected zone about the islands is maintained, and that both land and sea killing now yield an inconsiderable profit. The seal herd is in fact very far from actual extermination, although the point of commercial extermination, or that where the returns are wholly incommensurate with the amount of capital invested, has been nearly reached. But for the prompt action of the United States in 1869 this point would have been reached years ago, while but for its care of the islands ever since practical extermination would not be far off.

The example of the Southern fur-seal illustrates the rapidity with which commercial extermination may be effected, while the fate of the fur seals on the Farallones, Guadalupe and Juan Fernandez shows how readily actual extermination may take place. The Pribilof Islands are not, like those of the Antarctic, difficult of access, and their abandonment by this government would lead to the actual extirpation of the fur seals within a very few years. On the other hand, with proper protection the fur-seal herd can, with but little care and cost, be made an important source of revenue so long as fashion may decree the wearing of of seal-skin sacques.

THE PSYCHOLOGY OF THE PERSONAL EQUATION.

In the present paper the writer proposes to maintain the thesis that the personal equations of astronomers are mainly controlled by known laws of experimental psychology and hopes to assist his professional brethren in making use of the researches of the psychologists in such a manner that they shall avoid groundless hypotheses

which have often been harmful by leading to premature conclusions and thus have hindered the progress of our knowledge.

I do not wish to be considered as denying the possibility that the psychologists may learn something from the steady and well understood routine of the astronomers in their practical operations. In truth, almost the first step towards the measurement of the times occupied by mental processes was taken by the great astronomer Bessel in his classical memoir on 'Personal Equation,' which is reprinted in the third volume of Engelmann's edition of his 'Abhandlungen.' Bessel indicated there very clearly that the cause of the riddle which he partially solved was a psychical one, namely, the impossibility of comparing the impressions on two senses, sight and hearing, which take place exactly at the same instant. The 'eye and ear' observer who uses Bradley's method as modified by Maskelyne in noting down the time when a star image passes a fixed thread in his telescope makes the attempt to combine these two impressions, and in so doing necessarily 'apperceives' one of them before the other, and this produces 'personal equation,' or constant error in the time, which in seconds and fractions he notes down in his observing book. Bradley, in his journals of observation, noted vulgar fractions of the seconds. Maskelyne, Bradley's successor, failed to discover even the facts of personal equation, except in the work of one of his assistants. This case, that of Kinnebrook in 1795, was apparently settled by discharging the poor fellow as irregular and 'vitious' in his methods of observing. The personal equations of Maskelyne's other assistants were not known till many years later; Bessel's discovery, made about 1820, originated in his reading Maskelyne's notes about Kinnebrook's apparent want of skill. After the publication of Bessel's memoir the matter was followed up by W. Struve, Airy and other eminent astronomers, before the invention of the chronograph in 1849 had become the common property of astronomers. It led very soon to the thought that something similar had place in chronographic registration. This suspicion was fully confirmed before or soon after the 'American Method' was introduced at Greenwich.

In 1861 the psychological side of the investigation was taken up by Professor Wundt and led to the important discovery of the displacement of time when the observer attempts to fix the place on a divided scale of a continuously moving object. This displacement of time can lie in either direction, and thus an apparent difficulty is relieved which arises from the facts of personal equation as observed by Bessel, W. Struve and Argelander, and also by the astronomers who took part in Struve's chronometric expeditions of 1843 and 1844. The regular Greenwich investigations began with Airy's entrance upon the office of Astronomer Royal, in 1835, and have been continued to the present day.

The attempts by means of personal equation machines to determine the absolute personal equations of eye and ear observers led to the general result that most observers anticipate the true time of the transit, and that those who, like Argelander, fall behind it are fewer in number. If we take the average observer as the standard, as Sir George Airy seems to have intended, we find but few of those tested between 1835 and 1859 who fell behind the standard observer for the time, or behind the average of the body of observers in employment together at Greenwich. In my paper in the *Monthly Notices* of the Royal Astronomical Society for May, 1897, I have shown that the Greenwich observers since 1885 have anticipated their own times of chronographic transit by an amount not far from 0ˢ.13, on the average. One excellent observer,

Mr. Hollis, anticipates his own chronographic transit by 0ˢ.5, and does this, not because his eye and ear anticipation of the true time is very large, but because he employs the slower method of registration, first pointed out, if I mistake not, by Le Verrier, and his chronographic transits are about 0ˢ.2 later than those of the average observer. The difference 0ˢ.13 between the average observer's eye and ear transits and chronographic is about the average time of a 'simple reaction' according to the psychologists, and thus its amount confirms Wundt's view that chronographic registration by a practiced observer is closely analogous to the process of simple reaction. We thus reach the conclusion that the anticipation of such an average observer, added to the positive time which he requires to make a registration, is but 0ˢ.13, and a partial compensation would take place if the two methods were used in connection. The best form of personal equation machine is, as it appears, the Repsold Transit Micrometer. The tests which have been made of it, as of other contrivances for a similar end, are not entirely conclusive for various reasons, and the chief of them in this case seem to arise from the novel construction of the instrument and the short experience of the observers with it.

I quote from the *Astronomische Nachrichten*, No. 3,036, the following differences chronograph-Repsold Micrometer for Professor Becker and his colleagues :

	Chronograph-Repsold Micrometer.	Mean Error.
Becker	+ 0ˢ.319	± 0ˢ.009
Halm	0.224	0.009
Kobold	0.110	0.011
Zwink	0.158	0.016

These personal equations are of the same general order of magnitude as the reaction times found by a multitude of psychological experimenters. The largest differences among them may without much danger be ascribed to the same cause as the chronographic personal equation between Mr. Lewis, now standard observer at Greenwich, who employs the quicker method of registering, and Mr. Hollis, who employs the slower; their average differences for ten years is 0ˢ.24, varying very little from year to year, and that between Dr. Kobold and Professor Becker is 0ˢ.209 by the data given above and 0ˢ.255 by direct chronographic registration. The former registers rapidly and the latter slowly, but they do not give in the article cited any account of their psychical process.

Wundt, in his classical work 'Grundzüge der physiologischen Psychologie,' expresses the decided opinion that astronomers will do well to study the methods of the psychologists in dealing with personal equations, and this conviction I venture to consider as confirmed in a definite numerical way in my paper in the *Monthly Notices* to which I have referred. Additional arguments in favor of the psychological conclusion are not wanting and will be briefly stated. In the first place eye and ear observers note the times of transits differently when they observe stars on different sides of the zenith. There does not appear to be any certain general rule as to the sign of this form of equation. Chronographic observers register transits of time stars about 0ˢ.02 or 0ˢ.03 later when the direction of motion is opposite to the usual one. This agrees with the psychical law that unfamiliar circumstances tend to delay reaction. Faint stars are observed by chronograph later than brighter ones. This delay, about 0ˢ.013 per magnitude, has been tested by several of the most eminent observers now living and found to increase in amount as the stars approach that magnitude at which they are observed with difficulty by a given transit instrument. A similar delay in reaction to a sense impression, not a linear function of the intensity of the sense

impression, is found to be shown when the sense impression is faint. Even the amount 0ˢ.013 per magnitude is approximately indicated by the experiments of G. O. Berger and Professor Cattell, who have found, for a diminution in intensity to one-thousandth of its normal amount, a delay in the reaction to impressions on the sense of sight by 0ˢ.113 for himself as reagent and 0ˢ.108 for Dr. Cattell. The diminution in intensity corresponds to seven and one-half magnitudes on the usual astronomical scale: $7\frac{1}{2}$=log. 1000÷0.40 and the quotients 0ˢ.113÷$7\frac{1}{2}$ and 0ˢ.108÷$7\frac{1}{2}$ are approximately 0ˢ.013.

The eye and ear transits of very faint stars are liable to singular variations of personal equation; sometimes they are noted relatively too late and sometimes too early. Argelander suspected this last variation for himself and Auwers has proved it, and Argelander's explanation fits the phenomena as observed. He considers that according to Bessel's theory he 'first saw' and 'then heard,' but that when the star was very faint this displacement of time was reversed in direction. For stars not below the limit of magnitude where observation is easy this reversal did not take place. Auwers has shown that in similar cases Bauschinger observed very faint stars too soon by about one-tenth of a second of time. The reversal in Argelander's case produced a variation a good deal larger for extremely faint stars than Bauschinger's, but for either observer the fact of reversal is highly probable. In my paper before cited I give only a part of the details of the Greenwich observers' two-method personal equations. Those details which I do give indicate very clearly that the two-method personal equation varies from year to year, as had been previously found by Dr. Hilfiker, A.N., No. 2815. For example, Mr. Crommelin anticipated his own chronographic transits by 0ˢ.20 in 1892 and by 0ˢ.10 in 1893. Mr. Bryant by 0.07 in 1892 and −0ˢ.01 in 1893. Similar variability from year to year is indicated in the work of the veteran observers, H.T., A.D., T.L., and H., for whom only average values are given in my paper. Nor are such alterations of personal equation confined to the eye and ear personal equation or its difference from the chronographic. Professor Turner, Chief Assistant, anticipated Mr. Downing with the chronograph by 0ˢ.15 in 1886 and by 0ˢ.08 in 1888. Mr. Lewis, now 'standard observer,' anticipated Mr. Downing by 0ˢ.01 in 1886 and 0ˢ10 in 1891, and similar changes are visible in the eye and ear personal equations relative to the standard observer of the year. The instrument and stars were essentially the same for all the years between 1885 and 1893, so that the changes in the two-method personal equations are psychical variations in the habits and methods of registration and of noting eye and ear transits. The study of these habits and methods is plainly a branch of experimental psychology. We have already obtained some indications of how astronomers can promote this branch of study to their professional benefit as well as to that of psychological science. The simplest way for them to proceed is first of all to make more extensive comparisons of the eye and ear and chronographic method than have already been accomplished. Such comparison of eye and ear and chronographic transits of stars of various magnitudes would with little trouble extend our knowledge of the subject to a considerable degree. The Greenwich astronomers have detected the 'Gill equation' in chronographic transits; especially with the altazimuth. The same form of personal equation has been found in Professor Küstner's Berlin observations and by Mr. Tucker, of the Lick observatory, in his own. The 'Helligkeitsgleichung' for chronographic transits is, as before stated, already well

known and exhibits some uniformity. The great observatories which still so effectively employ the eye and ear method have a wide field of investigation open to them for the places of unknown stars which are not too faint to be more advantageously observed by eye and ear than by chronograph. Of course, immediate micrometrical measurement would give us enough material for completely settling the 'Helligkeitsgleichung' for most living astronomers. Stars within five degrees of either pole can now be observed by the Greenwich method, and the doubts and perplexities which hinder the accurate study of their right ascensions will soon vanish.

The Repsold micrometer, already an indispensable tool in determinations of longitude, is not well enough known to enable the observers to omit the exchange of their own stations and instruments.

But the numbers obtained by its use cannot, I suppose, yet be called absolute personal equations, but from them I venture to guess that the difference between the largest 0.319 for ProfessorBecker and the smallest 0.110 for Dr. Kobold implies that Professor Becker employs the sensorial or deliberate form of registration and Dr. Kobold the motor or shortened form; as the difference between them, 0^s.209 with a mean error of 0.014, is nearly equal to that of 0^s.24 between Messrs. Lewis and Hollis at Greenwich from eleven years' comparisons, 1883–1893.

The conclusion which some astronomers appear to favor, that by Bradley's method, as well as by the chronographic, faint stars are observed relatively later than brighter ones, is shown not to be a safe one, because we have cited two examples of thoroughly skilful observers who observe very faint stars earlier than those whose observation by eye and ear is easiest and most accurate. There is also a series of 'Coefficients of the light equation collected by Professor Auwers in his Berlin Zone of the A. G. C.,' in which there is so little uniformity even as to sign that he is led to remark upon the uncertain and fragmentary nature of the results in this matter; so far as obtained by astronomers. If the eye and ear observer is careful not to observe transits of stars too faint to be seen in the illuminated field, we are partially justified in concluding with Bauschinger that the 'Helligkeitsgleichung' is not then a sensible form of personal equation for eye and ear work, and we can also conclude that it deserves attention chiefly in its psychical aspect and that the method of making good eye and ear observations of transit is to make sure by ingrained habit of the uniformity of the psychical process from star to star, especially when the attempt is made to determine the right ascension of faint stars like the fainter ones of the 'Durchmusterung.'

The writer is not aware that any other astronomer has made the attempt to compare the numerical results of the psychologists with the personal equations as determined in the usual routine of observatory work, and is inclined to recommend the continuance of such comparisons in directions which at once suggest themselves.

First. Comparisons of eye and ear and chronographic transits of stars in various magnitudes and declinations.

Second. Comparisons of observations by both methods with the Repsold Transit Micrometer.

The subject of this paper is so broad and goes so deeply into many problems of practical astronomy where high accuracy is aimed at that the writer can only express regret that his attempts to deal with the matter have been so inadequate, and hopes that at a future time he may be able to prosecute it farther by the kind assistance of his colleagues and pupils.

Truman Henry Safford.

Williams College,
Williamstown, Mass., August 1, 1897.

THE PROGRESS AND ACHIEVEMENTS OF HYGIENE.*

HYGIENE is a department of medicine whose object is the preservation and promotion of health and deals, therefore, with all the various factors likely to influence our physical welfare. It is not an independent science, but rather the application of the teachings of physiology, chemistry, physics, meteorology, pathology, statistics, epidemiology and bacteriology to the maintenance of the health and life of individuals and communities. The subject is very properly divided into personal and public hygiene. In the former the doctrines are applied to individuals, in the latter to communities.

This branch of medicine has received such an impetus within the last twenty-five years that many persons regard it of modern origin; such, however, is not the case, for on turning to early history we almost invariably find that the health of the population has been made a subject of legislation. Hygiene was practiced by the Egyptians, who paid special attention to their diet and the care of children; they knew the dangers of floods to health, and resorted to preventive measures against their occurrence, as well as against the spread of contagious diseases.

The old Indians paid special attention to diet, habitation, exercise and the isolation of children in case of infectious diseases. The Mosaic code of laws contains minute directions for the cleanliness of the person, the purification of the dwelling and camp, the selection of healthy and avoidance of unwholesome food, the seclusion of persons with contagious diseases, the regulation of sexual functions, etc. The sanitary code, especially that part which relates to the slaughtering of animals, the food supply, its preparation, care of utensils for cooking, eating and drinking, personal cleanliness and frequent ablutions of the hands, appear peculiarly appropriate, since our knowledge of infectious disease germs, and it is a singular fact that, from some cause or causes, this race presents an endurance against disease that does not belong to other portions of the civilized communities amongst which its members dwell.

This resistance dates from the first to the last periods of life. Hoffmann finds that in Germany the number of still-born amongst the Jews was 1 in 39, and of the other races 1 in 40. Mayer determined that Hebrew children from one to five years of age die in the proportion of 10% as against 14% among the Christian children. After the fifth year the value of life still continues in favor of the Jews; the average duration of the life of the Jew being 48 years and 9 months, and of the Christian scarcely 40 years. In the census statistics of 1890, Dr. Billings has investigated the subject and developed the fact that the death-rate among the Jews in our own country is very low, being only 7.11 per 1,000, a little more than one-half the annual death-rate among other persons of the same social class and conditions of life, but the facts of most interest brought out are the low marriage rate, 7.4 per 1,000, as compared with 18 to 22 per 1,000 among the general population, and the low birth-rate, which was 4.66 for each mother. The number of Jewish children under 5 years of age in this country is therefore less, being in the proportion of 9 to 13, of the average population, but from 5 to 15 years it is greater in the proportion of 29 to 23. The causes for the higher vitality of the Jewish race have been earnestly searched for, because that race which presents the strongest vitality, the greatest increase of life and the longest resistance to death must in course of time become dominant. The causes may be summed up in the term

* Read before the Anthropological Society, Washington, D. C., May 4, 1897.

'soberness of life.' The Jew drinks less than his Christian brother; he takes as a rule better food; he takes better care of his poor and he takes better care of himself. How much his sanitary code of laws has accomplished in this direction I will not undertake to estimate.

A study of the habits of the primitive peoples in different parts of the globe shows that a desire to prevent disease is innate to all men. Among matters of personal hygiene may be mentioned massage for the purpose of overcoming fatigue, ocean, river, hot-air and vapor baths as practiced among many Indian tribes, the employment of eye-protectors against the glaring effects of snow among the inhabiants of the Arctic region, the use of respirators by the Kwixpagmut, an Eskimo tribe, to prevent the inhalation of smoke during their sweat baths. (Max Bartels, p. 222).

Many of our North American Indians have their medicine dances, the chief object of which appears to be the preservation of health. Thus the men of the Nez Perces tribe, between the ages of 18 and 40, assemble annually for the purpose of conquering 'Mawisch,' the spirit of fatigue; the ceremony lasts from three to seven days, and consists in the introduction of willow bougies into the stomach, followed by hot and cold baths and abstinence from food. The Indians are of the firm belief that they secure thereby increased strength and power of endurance (Bancroft), and I see no reason why a perfect cleansing of the body and temporary fasting should not result in a thorough purification of the blood and tissues, a more perfect metabolism and increased nutrition and power of resistance of the individual cells.

The disposal of the dead by cremation, and the destruction of the tepee and personal effects by fire after fatal cases, is a practice in vogue among a number of Indian tribes, and are worthy of mention, as fire is the best known germicide. Many of these primitive peoples appear to have correct ideas as to the communicability of certain diseases. Ehrenreich tells us that consumption prevails extensively among the Karayá in Brazil, and whenever a stranger approaches their huts he is asked whether he suffers from a cough, and unless the answer is negative he is not admitted—a very suggestive precept in view of the fact that scientific medicine has established the infectious character of tuberculosis. Pallas writes that the Kirgise during small-pox epidemics do not hesitate to use their arrows if necessary to keep infected subjects from entering their homes. In passing I may remark that such a brutal system of quarantine was practiced only last year in our country. A man suffering from small-pox was expelled from Arkansas and refused admittance into Mississippi. As he could not remain in or on the Mississippi River until the disease ran its course, he attempted to evade the quarantine and land on the river bank in the latter State, but was shot and killed by one of the quarantine officers.

As an example of public health measures may be mentioned the fact that Harmond, during an expedition to Mé Không, in Farther India, in the land of the Khâs, found, suspended outside of all villages which had been previously visited by cholera, a piece of wood, carved with a sign language to the effect, "Whosoever dares to invade our palisade during the next twelve days will be imprisoned and must pay a fine of four buffaloes and twelve ticals;" the sign on the reverse side gave the number of men, women and children in the village. The same observer noticed that the inhabitants of villages occupied by the Attapeu, which are close neighbors of the tribe of Laotes, laid pieces of lumber in the form of a star across their roads and paths, or suspended similar signs with bunches of leaves with-

out the gates of their settlement, to warn strangers of the prevalence of an epidemic among men or beasts within. The natives of the island of Keisar interdict marriage with lepers, evidently believing that leprosy is not contagious but is transmitted by heredity, while the natives of the Watubela islands believe the converse and transport their lepers to Gorong for isolation and treatment.

The practice of isolating contagious disease, especially during epidemics, appears to be quite common. Thus, at the island of Nias small-pox patients are sent to a temporary shelter outside of the camp and placed in charge of a relative, protected by a previous attack. The Traos of Cochin China, the Tunguse and Burates abandon their small-pox patients after providing them with boiled rice and water. Some of the Indian tribes in northern Mexico also abandon their contagious cases after placing water and wild fruits within easy reach.

But, to return to the Aryan race, we find that the Greeks and Romans, although not, like the Jews, making hygiene a part of their religious duty, paid special attention to the physical culture of their youth, endeavoring, by a rational care of the body, to promote the culture of their mind, and to secure freshness and energy, courage, presence of mind, grace and dignity. "The laws of Lycurgus," says Dr. Gardner, "are not wanting in very pointed enactments on sanitary matters, and the importance attached by all the Greek republics and in the Platonic ideal polity to physical culture is too well known to require further comment;" they paid, also, much attention to the water-supply, constructed numerous aqueducts, and Athens was provided with sewers at an early period of its history.

The teachings of Hippocrates, 400 B. C., doubtless bore many fruits, and whether it is true or not, as stated by Galen, that he ordered, during a pestilence at Athens, aromatic fumigation and large fires in the streets, we have at least his writings on air, water, soil, habitations and occupations and his views of local and seasonal influences on sporadic and epidemic diseases. In Homer's Odyssey reference is made to Ulysses purifying his house with burning sulphur, and Aristotle in his Politica shows his sanitary acumen when he says: "The greatest influence upon health is exerted by those things which we most freely and frequently require for our existence, and this is especially true of water and air."

The Romans, amidst their military operations, found time to construct the 'Cloaca maxima' about 2,400 years ago, which not only served for the removal of refuse, but also helped to drain many of the marshes, and constitutes the principal sewer of modern Rome. Aqueducts were made to cover miles upon miles of the surrounding plains, and their splendid ruins, many of which have been restored and are now used for their original purpose,attest the munificence and abundance with which the first of sanitary requisites was supplied to the Eternal City. At one time Rome had 14 large and 20 small aqueducts, some of which carried the water from a distance of 50 kilometers, and during the reigns of Tiberius and Nero the per capita supply was over 1,400 liters a day. It is stated that between 400 B. C. and 180 A. D. about 800 public baths were established, among them the 'Thermae Caracallæ,' which alone could accommodate 3,000 bathers at one time. It has often been charged, how justly I cannot say, that one of the first things the Christians did in Rome was to try to tear down the baths and convert them into churches; but when we see in our own midst the attempt to convert these useful institutions into abodes of vice, we can imagine how, with a licentious people like the Romans, their baths had degenerated into hotbeds of iniquity.

During the reign of the Cæsars attempts were made to drain the Pontine Marshes, sanitary officials and physicians to the poor were appointed and homes for poor girls and orphans were established. In the meantime the true spirit of Christianity asserted itself, and we read of the establishment of hospitals as early as the 4th century; these were speedily followed by infant and orphan asylums and homes for the poor and incurables. During the Middle Ages sanitation received a decided check, ignorance and brutal prejudices appear to have been the ruling spirit, and for many reasons it was the most insanitary era in history.

About this time most of the towns in Europe were built in a compact form, surrounded with walls; the streets were narrow and often winding for defensive purposes, shutting out light and air from the houses. The accumulation of filth was simply frightful. Stables and houses were close neighbors, human filth was thrown on the streets or manure heap. A city ordinance of Muhlberg in 1367 prescribed that manure deposited by householders on the market space must not be allowed to remain longer than 14 days. The dead were buried within the churchyards. Sewers and aqueducts having been permitted to fall into disuse, the inhabitants were compelled to resort to wells with polluted subsoil water. All the conditions were favorable for the spread of infectious diseases, and in the 14th century the Oriental pest or bubonic plague carried off in Germany over a million victims. Venice lost 100,000 and Florence 50,000 of its inhabitants; England lost one-half of its people, and London, then a city of 110,000 residents, buried over 50,000 in one cemetery. According to conservative estimates the deaths from this plague in Europe amounted to from 25 to 30 million people. The majority of people regarded the plague as the dispensation of God's providence, an evidence of divine wrath, which they hoped to allay by all sorts of self-inflicted punishments, and the passion plays of Oberammergau and elsewhere originated about this time. Others accused the Jews of being the cause, and hundreds were burned at the stake until Pope Urban IV. placed them under his special protection. The Faculty of Paris attributed the epidemic to the conjunction of planets on a certain day in 1345, and the Faculty of Leipzig, with equal gravity, asserted that it was connected with earthquakes, unseen waves of air, inundations, etc. Venice, alone of all Europe, took a sensible view of the matter, and for the first time in history, in 1348, appointed three guardians of public health, and the rules adopted later to isolate infected houses and districts for forty days has given rise to the term quarantine (from quaranta giorni).

We are told that this board rendered excellent service in matters relating to public sanitation, the control of markets and the sale of unwholesome foods, etc., and also inaugurated a system of mortality reports with columns for the insertion of the cause of death, showing that they fully appreciated the importance of vital statistics in the study of the causes and prevention of disease. This question is scarcely understood at the present day, and yet, as remarked by Dr. Billings, "when we wish to study the healthfulness of a city, whether it is getting better or worse, or judge correctly the effects of certain sanitary laws, we should not only know the number of deaths, but also the amount and character of the prevalent diseases, together with accurate information as to the number of population at different ages."

The repeated invasion of the Oriental pest appears to have everywhere compelled some sanitary efforts and an imperial decree in 1426 required the appointment of city

physicians throughout Germany, whose duty it was to adopt preventive measures.

A city ordinance of Nürnberg in 1562 gives detailed directions as to the quality of bread, beer and wine offered for sale, the cleaning of streets and houses, the disposition of infected clothing and bedding, the fumigation with sulphur and straw of pest-houses, etc.

In 1685 Prussia established a Central Medical Bureau, and appointments of health officers and privy medical counsellors were made, whose duties consisted in advising the men entrusted with the care of the government on matters relating to public health, and some of these titles are still in vogue in Europe. About the same time sanitary improvements in the way of widening streets for the purpose of supplying more air and light to the habitations, and better methods for the collection and removal of the wastes of human life were introduced, but, broadly speaking, at the close of the 17th century the habits of the people in Europe were generally filthy and in striking contrast to those observed among the most untutored savages of the present day.

In Madrid, we are told, that not even a privy existed in 1760. It was customary to throw the ordure out of the windows at night, and it was removed by scavengers the next day. An ordinance having been issued by the king that every householder should build a privy, the people violently opposed it as an arbitrary proceeding, and the physicians remonstrated against it, alleging that the filth absorbed the unwholesome particles of the air which otherwise would be taken into the human body. His majesty, however, with commendable zeal, persisted, but many of his citizens, in order to keep their food wholesome, erected privies close to their kitchen fireplaces.

With such unsanitary conditions we need be surprised that the mortality in towns was greater than their birth-rate and that the city population had to be recruited continually from the country, conditions which existed until the beginning of the present century. Professor Finklenburg, of Bonn, estimates that the average human life in the 16th century was only 18 to 20 years, while to-day it is over 40 years.

The mortality of London between 1660 and 1679 was 50 per 1,000 of inhabitants; from 1679 to 1728, including the period of pests, it was 80 per 1,000; between 1728 and 1780 it was still 40 per 1,000, while at the present time it is between 20 and 21 per 1,000, and the mean annual death-rate in England is less than 19 per 1,000. Without underestimating the brilliant achievements of Jenner's discovery of vaccination in 1796, which as a preventive measure has saved millions of lives, no two factors have contributed so much to the general result than the improvement of the air we breathe and the water we drink. Indeed, we have ample evidence that, with the introduction of sewers and public water supplies, the general mortality in numerous cities, during the past forty years, has been reduced fully one-half, the good effects being especially shown by a marked decrease in the number of cases of typhoid fever, diarrhœal diseases and consumption. The vital statistics of Great Britain furnish the proof. The mortality of Salisbury within the last 30 years has been reduced from 40 to 16 per 1,000; at Dover from 28 to 14 per 1,000; at Rugby from 24 to 10 per 1,000; at Croydon from 28 to 15 per 1,000 and at Matlock from 18 to 9 per 1,000.

		Enteric Fever.	Diarrhœa.	Consumpt'n.
Bristol,	before sanitary works	10.0	10.5	31.0
"	after " "	6.5	9.1	25.5
Leicester,	before " "	14.7	16.0	43.3
"	after " "	7.7	19.3	29.3
Cardiff,	before " "	17.5	17.2	34.7
"	after " "	10.5	4.5	28.6
Mucclesfield,	before " "	14.2	11.0	51.5
"	after " "	8.5	9.0	35.3
Warwick,	before " "	19.0	5.7	40.0
"	after " "	9.0	8.0	32.3

Stratford,	before sanitary works	12.5	11.2	26.6
"	after " "	4.0	5.7	26.5
Ashby,	before " "	13.3	4.0	25.5
"	after " "	5.7	8.3	31.3
Dover,	before " "	14.0	9.5	25.5
"	after " "	9.0	7.0	21.2
Croydon,	before " "	15.0	10.0	—
"	after " "	5.5	7.0	—

Now let us see what a pure water supply has accomplished. A summary of the evidence on this subject reveals the significant fact that cities, both at home and abroad, in which there has been the most marked decrease in the typhoid-fever death-rate, are those in which a pure supply has been substituted for a pre-existing contaminated one. Thus, for example, the typhoid-fever death-rate in Boston in 1846–1849 was still 17.4 per 10,000; in 1890–1892 it had fallen to 3.2 per 10,000, the city having in the meantime expended $25,000,000 on its water supply. The rate from this disease in Lawrence, Mass., for five years prior to 1893 was 12.7 per 10,000. After the establishment of sand filters, in September, 1893, the rate fell during the first twelve months to 5.2 per 10,000. In other words, 48 human lives at a value of $5,000 each, or a total value of $220,000, were saved to that city by an expenditure of only $65,000 for the plant and $4,000 running expenses per year. The typhoid-fever death-rate in Chicago in 1892 was 14.3 per 10,000. After improving the water supply it fell to 5.6 per 10,000. In 1874 the rate in Vienna was 11.5 per 10,000, and, with the introduction of a pure water supply, it has fallen to less than 2 per 10,000. The experience of London, Berlin, Munich and a host of other cities has been precisely the same.

Munich was notorious for its excessive typhoid-fever death-rate, it being 29 per 10,000 in 1856. With the introduction of a pure water supply and improved sewer system it has fallen to less than 2 per 10,000.

The question has passed beyond the speculative or experimental stage. Conservative cities are not in the habit of authorizing the expenditure of large sums of money without counting the cost and results; and the mortality statistics have furnished more eloquent and conclusive arguments than the most zealous advocates of sanitary reforms.

An abundance of water does not limit the spread of typhoid fever, for New York City, with only 78 gallons per head a day, has only 2.3 deaths; while this city, with a daily per capita consumption of 173 gallons, furnishes 8.12 deaths, and stands to-day No. 7 on the list of 54 American cities as regards an excessive death-rate from typhoid fever, only Denver, Allegheny, Camden, Pittsburg, Newark and Charleston furnish a higher rate.

Let us advocate, therefore, an ample quantity of pure water, and until this is accomplished let us filter and boil our drinking water, boil our milk, and thoroughly disinfect the excreta of typhoid-fever patients. The present century can boast therefore, of many advances in hygiene, particularly since the European invasion of cholera in 1830. The English towns and cities which had been visited by this disease and those fearing similar scourges were perfectly willing to profit by the investigations of the causes of infectious diseases and freely instituted sanitary reforms in the establishment of sewers, public water supplies, sanitary homes, etc. The example of England was followed by all civilized nations, with similar results. The effects of sanitation, as taught by Dr. Parkes, were demonstrated during the Crimean War and, as beautifully expressed by Virchow during our Civil War, reached 'the highest point in humane efforts ever attained in a great war.'

A study of the causes of infectious diseases also suggested more enlightened means for their prevention or mitigation, as the compulsory vaccination against small-pox, compulsory isolation and disin-

fection in a number of infectious diseases, the prevention of soil and water pollution for the restriction of typhoid fever, cholera, dysentery and other water-borne diseases, and, finally, the labors of Pasteur, Koch, and Sternberg of our country, in the identification and destruction of disease germs, have accomplished a great deal and opened a field of preventive inoculations which promises other practical results. The medical profession speaks of preventable diseases, and the Prince of Wales, in his opening address at the International Congress of Hygiene, held in London in 1891, very properly said: "If certain diseases are preventable, why are they not prevented?" The facts are that whilst the scientific physician knows fully well that if, for example, the dejecta of every typhoid-fever patient were promptly disinfected with germicides, typhoid fever would be stamped out in the course of a few years, he is not in a position to enforce this opinion by effective laws.

To illustrate what germicides and antiseptic methods have accomplished, let me remind you that the mortality from all amputations in the Crimean War (1854–55) was 63.5 per cent., in our Civil War it was still 48.7 per cent., but this percentage has steadily fallen until, in 1890, it was only 6.9 per cent. A century ago the mortality from puerperal fever at the lying-in department of the Hotel Dieu in Paris amounted to 10%. Semmelweis, in 1847, first insisted upon compulsory antiseptic midwifery, and since that time the mortality has fallen in all well-regulated maternities to less than one per cent. Witness, also, the advances made in the construction of model hospitals, asylums, schools, prisons and industrial establishments in relation to light, heating, ventilation, etc.

At the close of the last century the mortality among the inmates of French prisons was 250 *pro mille;* in the German prisons, in the forties, it was between 34 and 60 per 1,000, while in 1878 to 1882 it had fallen to 27 per 1,000.

In the matter of personal hygiene much has been done in the way of improved dietetics, clothing, exercise, and especially in the care and feeding of infants, but much remains to be done.

I will not weary you with a recital of what other countries have accomplished in the way of national and local health boards, enactment of health laws, the enforcement of sanitary police regulations, laws for the suppression of quackery and quack remedies, all of which have contributed greatly to the sum-total in the field of public sanitation.

While the people of the United States were not slow in adopting and originating sanitary measures of great value, our ideas of personal liberty, guaranteed to us by the Constitution, evidently prevented early legislation in matters of public health, except in matters of State quarantine, for fear that such legislation might affect the personal habits of the citizen and lessen his freedom of action. At all events, the first State Board of Health was established in Massachusetts only in 1869, since which time nearly all of the other States have followed her example. In 1872 the American Public Health Association was organized, and numbering, as it does, among its members some of the best minds in the profession, much good has been accomplished by this body and the so-called 'sanitary conventions' in molding public opinion and in framing and recommending health laws.

Measures for the control and restriction of contagious diseases have been adopted by most of the Health Boards, and a number of States enforce compulsory vaccination for school children, and have passed laws regulating the sale of poisons, and for the prevention of food and drug adulterations, and the extermination of bovine tubercu-

losis. In 1879 Congress created a National Board of Health, whose duty it was to make investigations into the causes and means of prevention of contagious and infectious diseases, to indicate measures of national importance and to be a center of information for all matters relating to public health. For want of appropriation this important body has ceased to exist, and since 1883 the duties relating to international and interstate quarantine have been discharged by the Surgeon-General of the Marine Hospital Service; his bureau, apart from the management of hospitals and stations for the care of sick and disabled seamen of the merchant marine, has also undertaken the collection and dissemination of mortality statistics and sanitary information, scientific investigation into the causes of disease, the physical examination of immigrants under the law excluding those affected with contagious disease—service in the office of consuls at foreign ports to assure the accuracy of bills of health—and other miscellaneous duties. Since Congress has failed to act upon the President's repeated recommendation and the petition of numerous medical societies for the creation of a National Health establishment, there is no good reason why the scope of duties and powers exercised by the Marine Hospital Service should not be enlarged.

An advisory board, composed of one representative from the various State Boards of Health, the chiefs of the medical department of the army and navy, and of the Bureau of Animal Industry, Census and Weather Bureau, and one of the legal officers of the government, could meet once or twice a year and decide upon a line of work for the promotion of public health.

One of the most pressing needs is an investigation into the pollution of water-supplies when such pollution affects or threatens to affect the sanitary condition of the people of more than one State, because the individual States are powerless to protect themselves against the misdeeds of their neighbors. Mr. Barthold's bill for the appointment of a River Pollution Commission, two years ago, was defeated; yet that same Congress appropriated $40,000 for the extermination of the Gipsy moth. England enjoyed the benefit of such a commission as early as 1855, and, in order to prevent, remedy and remove the danger of polluted water-supplies, adopted a comprehensive system for the disposal of sewage and of water filtration, the fruits of which have already been referred to.

We know that the Potomac River receives the drainage from every town and hamlet washed by its shores and tributaries, and what is true of the Potomac is equally true of the Ohio, Mississippi, Merrimac, Connecticut, Missouri, the Red River, the Columbia and Wabash Rivers, which are the sewers and, at the same time, the source of water supply for nearly all the cities located upon its banks, and these cities, as shown by the statistics collected by the Marine Hospital Service, show moreover a marked prevalence of typhoid fever, confirming what has elsewhere been proved, that this disease, as also cholera, dysentery and diarrhœal diseases, can be carried from one town or city to another by means of a water course.

Surgeon-General Wyman in a recent contribution estimates, from statistics received in his office, that every year there are no fewer than 45,000 deaths caused by typhoid fever alone throughout the United States, and, based upon an estimated mortality of 10%, it is within reason to assume a yearly prevalence of 450,000 cases of this disease. The average duration of a case of typhoid fever is not less than 30 days. If we calculate that an average of $1.00 is expended per day for care, treatment and loss of work, and that the value of a human life is $5,000 each, we have a total loss in

the United States of $238,500,000 per annum from one of the so-called preventable diseases. Reduce the prevalence of this single disease one-half, which has been accomplished in England, and the oft-recurring question: "How is it our fathers got along without these so-called modern improvements?" will be satisfactorily answered from an economic point of view.

Another subject which deserves special attention is the question of pure foods and drugs. It would lead me entirely too far even to touch upon all the gross frauds and their serious consequences which are daily perpetrated, but permit me to refer to a very universal article of food, viz., milk. Analyses of milk sold in New York City showed an average dilution with 33% of water, the fraud amounting to $10,000 per day. The State Inspector found 12% of water added and 20% of cream removed. The results in St. Louis, Chicago and this and every other city are similar, and indicate the desirability of stringent laws governing the milk traffic as a protection to the pocket of the consumer; but when we remember that Dr. Busey and the writer have collected and tabulated 138 epidemics of typhoid fever, 74 of scarlet fever and 28 epidemics of diphtheria, and that an analysis of the evidence showed that the poison of these diseases may reach the milk by soakage of the germs into the well water with which the utensils are washed, or by the intentional dilution with infected water; that the infection can be conveyed by animals wading in sewage-polluted water, or by the dairy employes acting as nurses, or suffering themselves from some mild infection while continuing their usual duties, or are convalescent from the disease; and that infection has taken place through the agency of scrubbing brushes, flies and other insects, exposure of the milk in or near to the sick rooms, or washing the patients with the same cloth used in wiping the dairy utensils, we see at once that dairies should be under sanitary control to prevent the propagation of disease by infected milk. This should include inspection of the dairy stock by competent veterinarians, so that the milk of animals suffering from bovine tuberculosis, erysipelas, anthrax, pleuropneumonia, foot and mouth disease, septic and other fevers, specific enteritis, rabies, tetanus, garget and other inflammatory conditions of the teats and udder may be excluded from the supply. Milk may also be rendered unfit for use by reason of improper food and care of the animal, or while the animal is being treated with powerful remedial agents. It is interesting to note that of the 240 milk epidemics collected by us, 187 were reported by English, 31 by American and 9 by Scandinavian observers; 8 came from German, 3 from Australian, and 1 each from French and Swiss sources. And right here it is suggested that the infrequency of milk-typhoid in France and Germany is due to the fact that milk is rarely used in its raw state on the Continent of Europe, and the germs are destroyed by sterilization.

The first movement towards securing comprehensive legislation against the adulteration of foods and drugs in this country was made in 1879. This is all the more surprising because Dr. Mann in his Medical Sketches of 1812 remarks that "the bread on the Niagara was made of damaged flour, such as was either not nutritious or absolutely deleterious." It was believed also that the flour contained in some instances an earthy substance, and that this adulterating substance was 'plaster of paris.' Again, during the Civil War, as early as in the winter of 1861–62, an extract of coffee furnished the troops in the vicinity of Alexandria produced nausea and vomiting in those who used it, and subsequently a government contractor, for having practiced

ood adulterations, was sentenced to a protracted imprisonment.

Instances, therefore, were not wanting pointing to the necessity of such laws; nevertheless, it was not until 1881 that three States, New Jersey, New York and Michigan, passed laws to prevent the adulteration of food and drugs. The law in New York commenced in the summer of 1882. At the close of the year 286 samples of food and drugs had been submitted to the public analysist for examination, of which 194 had been reported upon. Of 119 samples of food, 50 were found adulterated; while of 75 samples of drugs, 32 were adulterated.

Since 1883 quite a number of States have enacted similar laws, but I regret to say that in spite of the absolute necessity for such a law in this city, as revealed by the report of the chemist of the Health Office, the bill introduced during the last session of Congress failed to become a law. The majority of States have enacted laws to regulate the sale of poisons, but a careful study shows that they should be amended and greater restriction placed on the sale of poisons generally. A recent investigation, by a committee of the Medical and Surgical Society, into the extent of the opium habit in the District of Columbia, reveals the fact that during the past 10 years 7 persons died from the opium habit, 36 persons died from accidental or negligent opium poisoning, and 125 cases of opium poisoning and 70 patients were treated for the opium habit in our public hospitals. This does not include persons treated for acute or chronic opium poisoning in private practice. Investigation into the causes of the opium habit led to the conclusion that one class of subjects have contracted the habit by the use of the milder preparations of opium, and some of the various proprietary or secret remedies commonly employed as domestic remedies, such as paregoric, McMunn's elixir, diarrhœa mixtures, pain-killers, etc. Another class have evidently acquired the habit by the constant use of prescriptions containing opium or its preparations for the relief of pain, the individuals being at first quite unconscious of the enslaving nature of the drug. Still another class of persons belong to the moral degenerates of fast men and women, who have acquired the habit by contact with opium habitués including opium smokers, and through solicitation, invitation and persuasion have fallen victims to the vice.

Since the opium habit is often established by the unauthorized and indiscriminate renewal of prescriptions containing opiates, the New York Legislature very wisely enacted, in 1886, a law that no pharmacists shall refill more than once prescriptions containing opium or morphine, or preparations of either, in which the dose of opium shall exceed $\frac{1}{4}$ grain, or morphine $\frac{1}{20}$ grain, except with the verbal or written order of a physician. A similar bill was introduced into Congress during the winter session, but failed to become a law. This city is also without a law for the suppression of the opium joints, in spite of the fact that a man died a few months ago from the effects of opium smoking in one of the joints, of which there are two; and a conservative estimate places the number of habitual opium smokers in the city between 150 and 200.

It is clearly the duty of the State to close opium dens and restrict the sale of poisons, and in regard to the sale of patent and proprietary medicines containing poisonous drugs the contents should be expressed on the label and the word poison added.

At the risk of taxing your patience, permit me to refer to the subject of patent and proprietary medicines.

By the term patent medicine, as properly employed in this country, England and Europe generally, it must be understood

that the composition is known and can be seen at the Patent Office. The proprietary medicine is a secret preparation protected by a trade mark in this country, and hence preferred by the owner, but both are vaguely termed by the public patent medicines.

The extent of the traffic will be apparent when I tell you that up to December 31, 1896, the United States Patent Office had issued patents on the following:

Disinfectants	235
Extracts	226
Hair dyes and tonics	43
Insecticides	145
Internal remedies	356
Plasters	48
Topical remedies	351
Veterinary remedies	75

TRADE MARKS.

Drugs and chemicals	614
Medical compounds	4979

The proprietary medicines are subect to the control of the State authorities, and if containing alcohol in sufficient quantity to be intoxicants are subject to Internal Revenue Laws, but so far as my knowledge extends little or nothing has been done in this country and in England to control the sale of secret remedies. Dr. G. Danford Thomas, Coroner of London and Middlesex, before the International Congress of Hygiene in 1891, very justly urged that all proprietary medicines should be under the Patent Laws, because the composition is at least disclosed; he would abolish licences to sell them and confine the sale to chemists and druggists only. In these matters we could certainly profit by the example of the Japanese, Italian, French and German laws. The Japanese government has established a public laboratory for the analysis of chemicals and patent medicines. The proprietors are bound to supply a sample with the names and proportions of the ingredients, directions for its use and an explanation of the supposed efficacy. During the year 1889 there were no fewer than 11,904 applicants for licenses to prepare and sell 148,091 patent and secret medicines. Permission for the sale of 58,638 different kinds was granted; 8,592 were prohibited; 9,918 were ordered to be discountenanced, and 70,943 remained still to be reported on. The majority of those authorized to be sold were of no efficacy, and but few were really remedial agents. The sale of these was not prohibited, as they were not dangerous to the health of the people. No objection can be urged to this law from a sanitary point of view, except that it continues to protect the 'pseudo-scientist.'

In Italy (which country, by the way, has the best national board of health) the sale of secret remedies in January, 1891, became subject to the following regulations: The composition as to the quality and quantity of the active substances contained must be written on the labels and on the advertisements; no special therapeutic virtue or indication shall be attributed to them either on the label or advertisement; they shall be sold only by chemists under the vigilance of the sanitary authorities and with medical prescriptions.

In France the pharmacier is forbidden to sell secret remedies or even to keep them on his premises under heavy penalties.

In Germany the chemist may sell patent medicines when ordered by the prescription of the physician. He must not sell secret remedies. All patent medicines sold by the chemist must be prepared under special supervision and according to the rules of the pharmacopœa.

From the foregoing we may conclude that, while a good deal has been accomplished by public and private sanitation, much remains to be done before the average length of human life reaches threescore and ten.

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CONTRIBUTIONS TO OUR KNOWLEDGE OF MICRO-ORGANISMS AND STERILIZING PROCESSES IN THE CANNING INDUSTRIES.

In a paper read before the Society of Arts in October, 1896,* we showed the extent of the canning industry in this country, and the importance to it of accurate knowledge of the bacteriological principles of sterilization. In that paper we dealt with the packing of clams and lobsters, and described some of the bacteria which are active in the deterioration of these products in case sterilization is not complete. It is interesting to notice that some of the results which we published at that time have lately been confirmed by a specialist employed by the Canadian government† to investigate the discoloration of canned lobsters.

We now desire to put on record a preliminary account of our more recent investigations in another branch of the industry, viz., the packing of sweet corn. This art constitutes a very large industry, as is shown by the fact that in 1895 72,000,000 two-pound cans (72,000 tons) were packed in the United States. The growth of the business has been rapid, for it was not until about 1853 that corn was packed at all with success.

Sweet corn, when properly prepared, is one of the most valuable of all canned foods, as it retains much of its original flavor, is popular, and is sold at a price within the reach of all. If, however, the sterilizing has not been thoroughly done there may result fermentations caused by bacteria which have not been killed, producing what is known as 'sour' corn.

Our investigations commenced in February, 1897, with the examination of a large number of cans of sour corn. On opening the cans no change was noticeable to the eye, the corn appearing fresh and of a natural color. In some cases a sour odor could be detected, but in others this was not observed. It was to the taste that the trouble was most apparent, the corn being sour and of a peculiar, astringent flavor. Bacteriological examinations showed sound cans to be sterile, while spoiled cans invariably gave evidence of bacterial action. Pure cultures of six species were obtained, of which five were bacilli, and one was a micrococcus. By inoculating sterile cans of corn with these organisms we have been able to produce souring in all respects similar to that of the spoiled cans from which they were originally taken.

In order to study these fermentations more thoroughly and to ascertain, if possible, the source of the bacteria causing them, we spent nearly the whole of the corn-packing season of 1897 at an establishment in Oxford county, Maine, where every convenience for scientific study of the process was put at our disposal by the proprietors. We were thus enabled to thoroughly investigate the methods of procedure from the harvesting of the green corn to its ultimate shipment in cans. It is very necessary that the utmost cleanliness and dispatch should be observed in all the operations, so that the chances of infection from bacteria may be reduced to a minimum. In this factory the strictest caution was exercised in these respects, everything being kept scrupulously clean.

The corn is generally picked in the morning, and is delivered to the cannery as early as possible. One or two men make it their special duty to visit the farms once or twice a week during the season to keep informed as to the condition of the crop and to 'order in' the corn as it becomes sufficiently matured. As the ears are delivered at the factory they are arranged in low piles on the ground in an open shed to protect them from the sun. The husks and the silk are

* Technology Quarterly, Vol. X., No. 1.

† Supplement No. 2, 29th Annual Rep't, Department of Marine and Fisheries, Ottawa, 1897.

taken off by hand, and the corn is then quickly carried to the cutting machines, in which, by a series of knives and scrapers, the kernels are quickly and cleanly separated from the cob. Any stray bits of cob or silk which may be mixed with the corn are now taken out as it passes through the 'silker,' a machine arranged somewhat on the plan of a gravel-sifter, that is, with two cylindrical wire screens one inside the other, placed on an incline and rotating in opposite directions. The corn drops through the meshes of the screens, while the refuse passes out at the lower (open) end.

The corn is now weighed, mixed with water in the proper proportions, and is then ready for the 'cooker.' There are several varieties of these machines in use, all of which are alike in principle but differ somewhat in details of construction. Their object is to heat the corn evenly and quickly to a temperature of 82–88° C. (180–190°F.) and to deliver it automatically into the cans. A single machine fills about thirty cans a minute. After having been wiped, the cans are capped, soldered and tested for leaks. Sterilization, the final and most important step in the whole process, now follows, this being done in retorts, by steam under pressure. The length of heating, or 'processing,' and the pressure which is given vary somewhat in different factories.

As we have shown in our previous paper, in order to insure sterilization in practice, it is necessary to obtain and maintain a temperature in excess of 100° C. (212° F.) throughout the contents of the can. Intermittent sterilization may be employed, but is less efficient and is not practicable upon a large or commercial scale. We have found by experiment that sixty minutes at 121° C. (250° F.) is sufficient time for sterilizing corn, and it seems probable that this can be shortened somewhat or the temperature reduced. Further experiments are in progress to decide this question.

Through a demand that canned corn shall be very light in color there has been, apparently, a pressure put upon the packer to shorten the time of heating or to reduce the temperature in his retorts. The large losses which have resulted in recent years from sour corn have been due principally to this demand. By the use of registering thermometers we have proved that corn is a very poor conductor of heat, and that the time necessary to bring all portions of the center of the cans to the requisite temperature is a factor whose importance cannot be overestimated. We have proved by experiment that, with 13 pounds of steam in the retort, the corresponding temperature of which is 118.8° C. (246° F.), it requires 55 minutes for the same temperature to be registered at the center of a can placed in the middle of a retortful of corn. With the same pressure and under the same conditions at the end of 45 minutes a temperature of 114° C. (237.2° F.) was reached, and at the end of 30 minutes 108.3° C. (227° F.). Thus it is evident that with the present methods any reduction of time of heating is attended by considerable risk. If any means could be devised by which the heat would more quickly reach the center of the cans it might be safe to shorten the time of heating. There is a prospect that before long some such modifications may be possible.

We have made a careful bacteriological study of all the different steps in the process and of the corn as it comes from the field, and have found upon the corn in the field bacteria which appear to be identical with those isolated from cans of sour corn. Repeated tests of corn from the cob showed the presence of bacteria. Corn which had passed through the cooker, and cans of corn which had been 'retorted' for 30 minutes or less, also contained the same species of bacteria as were found upon the raw corn.

All these bacteria liquify gelatin, and

grow very rapidly, as is proved by the fact that streak cultures showed well marked growth four hours after inoculation. Detailed descriptions of the organisms and of many more experiments will be given in our full paper on this subject to appear in a forthcoming number of the *Technology Quarterly*.

S. C. Prescott,
W. Lyman Underwood.
Biological Laboratory, Mass. Institute of Technology.
Boston, November 12, 1897.

AMERICAN ORNITHOLOGISTS' UNION.

The Fifteenth Congress of the American Ornithologists' Union convened in New York City, Monday evening, November 8th. The public sessions, lasting three days, were held in the library of the American Museum of Natural History.

William Brewster, of Cambridge, Mass., was re-elected President; Dr. C. Hart Merriam and Robert Ridgway, of Washington, D. C., Vice Presidents; John H. Sage, of Portland, Conn., Secretary; William Dutcher, of New York City, Treasurer; Charles F. Batchelder, Frank M. Chapman, Chas. B. Cory, Ruthven Deane, Drs. Jonathan Dwight, Jr., A. K. Fisher and L. Stejneger, members of the Council. By a provision of the by-laws, the ex-Presidents of the Union, Dr. J. A. Allen, Dr. Elliott Coues, and Mr. D. G. Elliot, are *ex officio* members of the Council.

One active and eighty-eight associate members were elected. As a direct result of the Audubon Society movement, creating a popular interest in the study of birds, more women than usual were elected to associate membership.

An address in commemoration of Major Charles Emil Bendire, U. S. A., a distinguished member of the Union who died during the past year, was prepared by Dr. J. C. Merrill, U. S. A., and presented by Mr. Elliot. Major Bendire was a well-known oologist, and will always be remembered by his invaluable 'Life Histories of North American Birds.'

Dr. Coues exhibited the portfolio carried by John James Audubon in Europe and America, and also the original MS. of the first volume of his 'Ornithological Biography.' Some original bird-drawings by John Woodhouse Audubon were also shown.

Mr. Abbott H. Thayer, the eminent portrait painter, gave an out-of-door demonstration of the underlying principle of protective coloration, in continuation of his remarks on the subject at the previous meeting. Mr. Thayer showed a pair of decoys with the belly part cut off, so that in lying on the cut-off side they represented crouching birds or mammals. He then repeated upon them the coloring which he had exhibited at Cambridge upon entire decoys (decoys poised a few inches above the ground). This, he said, was to more clearly illustrate what he stated in his first paper on protective coloration, namely, that the normal gradation of sky's lighting is effaced *by the color gradation of the animal at every point*, the median dorsal line having the darkest markings, so that the gradation toward the white of the belly *begins close to this dorsal line*. Mr. Thayer placed the two decoys side by side on a plank, and covered one of them uniformly with the same dry earth which he spread about it on the plank, so that all of its visible surface and that of the plank on which it lay were absolutely of one tint—monochrome; yet it was conspicuously visible at a long distance, because of its normal gradation of shading from the sky's light, although there was no underside visible to show a culmination of shadow. The other decoy he painted in imitation of a hare's or snipe's gradation and so successfully that it became totally invisible at a distance of four or five yards. He explained that the statement in his first paper

that not a feather of the upper surfaces of the woodcock and grouse had been artificially colored referred only to the feathers along the median dorsal region.

The skin of a cottontail rabbit was exhibited, showing a most perfect gradation from the black hairs of the middle of the back and over the shoulders to the white of the belly.

This communication, in connection with that given at Cambridge a year ago, completes Mr. Thayer's admirable demonstration of his theory of the great underlying principle of protective coloration in animals.

On Wednesday evening, November 10th, an illustrated lecture entitled 'A Naturalist's Expedition to East Africa,' was given in the large lecture hall of the Museum by Mr. D. G. Elliot before an audience of some 1,500 persons.

Mr. Wm. Dutcher, Chairman of the 'Committee on Protection of North American Birds,' read a most interesting report on the work done during the past year. This report will be published in abstract in *The Auk*, and printed in full as a separate pamphlet.

Mr. Frank M. Chapman gave an exhibition of lantern slides of birds in nature, from material contributed by himself and other members of the Union. This was followed by Professor A. S. Bickmore with colored lantern slides showing recent advances in methods of visual instruction.

Dr. Coues remarked upon certain *Laridæ* which were before him, and Dr. Jonathan Dwight, Jr., showed a specimen of a new species of bird for North America (*Puffinus assimilis*).

An informal talk on the Gyrfalcons was given by Mr. Chapman, who exhibited specimens from Greenland and Labrador. Remarks followed by Dr. W. E. Hughes, who accompanied the first Peary expedition to north Greenland.

Following is a list of the papers read at the sessions, in addition to those already mentioned:

Protective Adaptations of Insects from an Ornithological Point of View: SYLVESTER D. JUDD.

Summer Birds of the West Virginia Spruce Belt: WILLIAM C. RIVES.

Is Uniformity in Local Lists Possible? JONATHAN DWIGHT, JR.

Ten Days among the Birds of Northern New Hampshire: JOHN N. CLARK.

Some Notes on Liberian Birds: HARRY C. OBERHOLSER.

Remarks on a New Theory of the Origin of Bird Migration: J. A. ALLEN.

Experiences of an Ornithologist in Mexico: FRANK M. CHAPMAN.

The Great Roosts on Gabberet Island, Opposite North St. Louis: O. WIDMANN.

The Terns of Gull Island, N. Y.: J. HARRIS REED.

The Petrels of Southern California: A. W. ANTHONY.

The Terns of Muskeget Island, Mass.: GEORGE H. MACKAY.

The Northern Raven Breeding in New England: H. K. JOB.

The Summer Birds of the Catskill Mountains, with remarks upon the Faunæ of the Region: EDWIN I. HAINES.

Breeding Habits of the Common Robin in Eastern Massachusetts: REGINALD WEBER HOWE, JR.

The next meeting of the Union will be held in Washington, D. C., commencing November 14, 1898.

JNO. H. SAGE,
Secretary.

CURRENT NOTES ON ANTHROPOLOGY.

THE ABORIGINAL ART OF ECUADOR.

THE well known Alpine explorer, Mr. Edward Whymper, during his expedition to the Andes made a considerable ethnographical collection in and near Ecuador, a description of which, with illustrations, is given by Mr. O. M. Dalton in the *Journal* of the Anthropological Institute for August.

The most interesting results refer to the forms of axes and similar stone implements. There are numerous types in Ecuador, many seemingly indigenous, while almost all the Colombian forms 'can easily be traced to a foreign source.' There are frequent instances of resemblance between

types common to the Antilles and Ecuador, and these resemblances are most abundant in the islands most accessible to the South American continent. It is also noted that one quite peculiar form of stone axe, with a depression at the butt and rounded lateral arms, which seems to have reached its perfected development in Ecuador, has been discovered also, both in stone and copper, in tombs of the IVth and XIIth dynasties of Egypt; another illustration of the parallelism of artistic development. The pottery of Ecuador, as shown in the collection, is closely assimilated to that of Chiriqui and other parts of Central America.

THE BERBERS OF MOROCCO.

THE most accurate description of this people since that of Quedlinberg is given by Mr. W. B. Harris in the *Journal* of the Anthropological Institute for August. He notes their complexion as nearly always fair, while many are red-haired, red-bearded, and with blue eyes. The Susis, however, south of the Atlas, and claiming to be of unadulterated Berber blood, are copper-colored, with high cheek bones and narrow dark eyes. This would seem to bear out Dr. Collignon's theory of a dark and light Berber type. The Riffians are distinguished by a 'scalp-lock,' which they allow to grow thick and long. It is plaited or twisted, and wound around the head. Mr. Harris does not explain its significance. In the central Atlas they still call themselves 'Berber' (plural Berebber), but the meaning of the term was not obtained.

They apparently have no knowledge of the old Hamitic or modern Tuareg alphabet, and he asserts that no writing in their tongue exists, though it is occasionally written in Arabic characters. Many tracts of the Riff country of the north have never been visited by Europeans, and the Sultan of Morocco exerts a merely nominal control over it.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

NOTES ON INORGANIC CHEMISTRY.

A CONTRIBUTION to the much discussed subject of the use of alum in foods is given in the last *Journal* of the American Chemical Society, by Professor C. F. Mabery and L. Goldsmith. The authors describe a series of tests as to the influence of varying quantities of alum on the peptic digestion of blood fibrin. In every case the digestive action was retarded by alum, even when present in very small quantity. In order to test the action under actual conditions, two loaves of bread were prepared, one with alum baking powder and the other with a cream-of-tartar-soda powder. Here, again, the peptic digestion was retarded in the case of the bread containing alum. Similar experiments carried out with salicylic acid, boric acid and with formalin showed that while there was with these antiseptics some retardation of the peptic digestion it was slight in comparison with that when alum was used.

THE cause of the rusting of iron which is covered with a protective layer of paint is usually attributed to minute cracks in the paint, occasioned by the unequal expansion of the iron and paint. Edmund Simon gives in *Dingler's Polytechnisches Journal* the results of a study of the conditions of this rusting, and concludes that paint stands changes in temperature, but is always hygroscopic, and when swollen by moisture is pervious both for water and gases. The best way to prevent such rusting is to use three or four coats of a paint, which adheres as closely as possible to the iron, and which contains the largest possible quantity of oil.

IN the *Zeitschrift für physikalische Chemie* John Gibson contends that in all cases the chemical action of light is such that the new products have a higher conductivity than the original. This is true in the case of selenium, sulfur, phosphorous and mercuric sulfid, in the combination of hy-

drogen and chlorin, and in the reduction of silver and mercury salts. The action of light on nitric acid seems to be the only exception, but this is only an apparent exception, as the conductivity of nitric acid solution increases up to 32 per cent. when the maximum is reached, whilst the decomposition by light ceases when the concentration has fallen to 47 per cent.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

THE anniversary meeting of the Royal Society will be held on Tuesday, November 30th, when the officers for the ensuing year will be elected. Lord Lister will be recommended for re-election as President.

THE new house of the American Society of Civil Engineers, 220 West Fifty-seventh street, erected at a cost of $200,000, was formally opened on November 24th. Addresses were made in the new auditorium in the afternoon by the President of the Society, Mr. B. M. Harrod, of New Orleans, and there was a reception in the evening.

THE Danish Geographical Society has awarded its gold medal to Dr. Sven Hedin.

DR. GUIDO SCHNEIDER has been appointed Director of the Biological Institute recently established at Sebastopol.

THE death is announced of Professor Henry Calderwood, since 1868 professor of moral philosophy in the University of Edinburgh, on November 20th, at the age of sixty-seven years. He was the author of numerous publications on education and philosophy, among the more important of which were the 'Relations of Science and Religion' (1881) and the 'Relations of Mind and Brain' (1879), the latter being one of the first systematic treatises on physiological psychology.

THE *Athenæum*, in announcing the death, on November 1st, of the Rev. Peter Bellinger Brodie, of Rowington, in Warwickshire, at the age of 82, states that while a student at Cambridge, Mr. Brodie, like so many others, acquired an enthusiastic love for geology, under the teaching of Professor Sedgwick. His name soon came to be identified with the study of fossil insects, and in 1845 he published a work on this subject. Mr. Brodie was elected a Fellow of the Geological Society as far back as 1834; and the Society recognized the value of his work by the award, in 1887, of the Murchison Medal. A selection from Mr. Brodie's extensive geological collections was acquired a short time ago by the British Museum.

WE regret also to record the following deaths among foreign men of science: Dr. G. H. Otto Vogler, aged seventy-five, a versatile writer on natural history; Dr. Johannes Frentzel, Director of the Biological Station on the Müggelsee, near Berlin, aged 38 years; Dr. L. A. Buchner, professor of pharmacology at Munich, aged eighty-four years; Professor Karl Müller, Director of the Experiment Station for Agricultural Chemistry at Hildesheim, and of Dr. Fr. Stohman, honorary professor of agricultural chemistry at Leipzig, aged sixty-five years.

THE report of the Commissioner of Patents upon the business of the Patent Office for the fiscal year ended June 30, 1897, shows that there were received within that year 43,524 applications for patents, of which 23,994 were granted, including reissues and designs. The number of patents which expired was 12,584. The number of allowed applications which were by operation of law forfeited for non-payment of final fees was 5,034. The total receipts were $1,343,779; the expenditures, approximately, were $1,026,644, leaving a surplus of $317,135. The moneys covered into the Treasury of the United States on account of receipts from fees, etc., in patent cases, from July 4, 1836, in excess of the cost of the management of the Patent Office, amounted to $5,093,614.

Nature states that an instructive fisheries exhibition, arranged to illustrate the fishing industries and the application of science to agriculture, has been opened in the Zoological Museum of the University College, Liverpool. The exhibits are fully described in a guide to the exhibition published by the authorities. There is a series of the food fishes of this district, with the more important food matters of each; also a series of useful and useless fishes

which compete with one another by eating the same food. Another exhibit contains specimens of the shell-fish of the district, showing stages in the life-history and growth, legal and illegal sizes, pearl formations and pearls. A case is devoted to a display of printed matter, photographs, drawings and lantern slides, illustrating the publications, both administrative and scientific, of the Lancashire Sea Fisheries Committee, and other work bearing upon the fisheries of the district. The drawings and sketches include a number made by Professor Herdman in illustration of his joint investigation with Professor Boyce on the diseases of oysters and the connection between the oyster and disease.

THE *Senckenbergische Naturforschende Gesellschaft* at Frankfort celebrated its eightieth anniversary on May 30th, and has now published its *Bericht*, giving an account of the celebration, including the official address by Professor Heinrich Reichenbach, the subject of which was 'A Review of the Progress of Biology during the Past Eighty Years.'

THE seventh International Congress of Navigation will be held at Brussels during July of next year.

THE Walsingham Medal for 1898 is offered at Cambridge University for a monograph or essay giving evidence of original research on any botanical, geological or zoological subject, zoology being understood to include animal morphology and physiology. The competition is open to graduates of the University who are under the standing of M. A. on October 10, 1898, on or before which date the essays are to be sent to Professor Newton, Magdalene College.

THE trustees of the New York Public Library, Astor, Lennox and Tilden Foundations, have announced that the design submitted by Carrere & Hastings for the new library building, to be erected on the site of the Forty-second street reservoir, has been accepted, and the prize in the competition awarded to that firm.

IN addition to the relief map of the State and of the Catskill regions issued by the University of the State of New York, the Regents have authorized one of the Adirondacks and another of Manhattan Island which will show its physical features before they were altered by civilization. The chief interest of this action is, however, in the notice to university institutions that duplicates of these relief maps will be made in quantity and furnished to the schools either for cash or as a part of their apportionment at a comparatively trifling cost, so that many schools can hereafter be provided with these valuable maps. 1,000 copies of the mushroom charts, the publication of which created so great interest that the edition was exhausted almost immediately, have been ordered by the Regents in chart form for wall use. Each institution will be entitled to one free in sheets or mounted on muslin and rollers by paying the cost of such mounting.

THE library of the late Professor Carl Vogt has been purchased by the Senckenbergische Naturforschende Gesellschaft of Frankfurt.

THE Paris *Conservatoire Nationale des Arts et Métiers* announces a series of public and free courses of lectures on the application of science to the arts. These lectures are given in the evenings and continue throughout the winter. The lecturers include M. J. Hirsch, M. J. Violle, M. Marcel Deprès, M. Th. Schloesing and other eminent French men of science.

AT the anniversary meeting of the New York Academy of Medicine, on November 18th, an address was given by Dr. Hermann M. Biggs on 'Sanitary Science, the Medical Profession and the Public.'

A REPORT by M Descubes has been presented to the French Chambers of Deputies recommending the plan of connecting Paris with the sea by a maritime canal, proposed by M. de la Grie. The length of this canal would be 185 km., its width at least 35 m., and its depth 6.20 m. The cost is estimated at about $30,000,000, and M. de la Grie is prepared to organize a company to construct the canal if it is allowed the right to collect tolls for ninety-nine years.

AT a recent meeting of the New York Library Club, Dr. John S. Billings described the method of disinfection of books by formalin vapor. He said, according to the New York *Medical Record*, that in some experiments made recently, at the laboratory of the University of

Pennsylvania, a saucer of formalin, a book which had been infected with the bacteria of diphtheria, another with scarlet fever, and another with erysipelas, were placed under a bell jar. The experiment showed that one cubic centimeter of formalin to three hundred cubic centimeters of space would thoroughly disinfect any book in fifteen minutes.

IT is possible that the beaver will survive longer in Europe than in America. It is said that a few individuals are still to be found on the Elbe, the Rhine and the Danube, and Professor Collett, of Christiania, estimates, according to *Cosmos*, that there are now 100 individuals living in Norway, whereas the number in 1880 was estimated at 60. Professor Collett recommends that government protection be afforded to prevent their extermination.

DR. MAX SCHLOSSER has just issued his *Literaturbericht* of Anthropology and of the Living and Fossil Mammals for the year 1893—a quarto abstract of 82 pages, in fine type, containing critical notices and digests of all the contributions to these subjects during the year. This abstract is from the *Archiv für Anthropologie*, Band 24, and it is an invaluable aid to zoölogists and paleontologists in all parts of the world, especially because it gives the contents of many papers which are not accessible to readers on this side of the water.

DR. BERGER has published the original Italian text, with comments, of a manuscript discovered by him in the Vatican Library in the hand writing of Michael Angelo. It gives a series of prescriptions and treatments for diseases of the eye which it is supposed he collected in view of his own failing eyesight.

THE last issue of the Masters of Medicine series, published by Mr. Fisher Unwin, London, is 'William Harvey,' by D'Arcy Power.

THE *Atlantic Monthly* promises for next year a series of articles by Mr. John Muir, describing The Great Government Reservations, The Yellowstone Park, The Yosemite Park, and The Sequoia Parks; a series by Dr. T. J. J. See on the 'Origin of the Universe,' and a group of articles on modern psychology and its contributions to education, as also articles by Professor C. S. Sargent on the preservation of the forests and by Professor D. G. Brinton on results of American archæological investigations.

MR. BERNARD QUARITCH, London, offers for sale a complete set of the 'Philosophical Transactions of the Royal Society' for £240. The set includes the 'Philosophical Collections' by Robert Hook, seven numbers complete, published in 1679–1682, during which time the Philosophical Transactions were interrupted, which were intended to supply the gap.

THE Open Court Publishing Company, Chicago, propose issuing a series of life-size portraits of eminent philosophers and men of science, should the advance subscriptions warrant the undertaking. They have prepared a preliminary list of sixty-two philosophers and psychologists and offer this set for $7.50. We trust that this very reasonable price, and the value of the work already done in this direction by the Open Court Publishing Company, will secure a sufficient number of subscriptions to lead them to publish the series, and to follow it as they suggest with series of mathematicians, physicists, biologists, etc.

IT is perhaps worthy of note as indicating tendencies of scientific development that of the thirty-six philosophers given in the series drawn up by the Open Court Publishing Company all are dead except one, whereas a large proportion of the psychologists are now living. The list of psychologists is as follows: Cabanis, Maine de Biran, Beneke, G. E. Müller, E. H. Weber, Fechner, Helmholtz, Hering, Aubert, Mach, Stumpf, Munk, Exner, Wernicke, Steinthal, Brentano, Paul Janet, Ribot, Taine, Fouillée, Binet, Bain, Romanes, C. Lloyd Morgan, Bastian, William James. The omission of Wundt's name from the list is probably through inadvertence. In the English names biology is emphasized at the expense of psychology. The names of Ladd and Hall should be added to give America its fair representation.

THE Smithsonian Institution is about to print, in its *Miscellaneous Contributions*, a work entitled 'List of Recorded Earthquakes on the Pacific Coast, 1769–1897' (illustrated), by Edward S. Holden. The data are derived from a similar list of recorded earthquakes, 1769–1888 (with a very considerable number of additions

and a few corrections), which was issued by the University of California in 1888, and from the annual publications of the Lick Observatory (printed in the *American Journal of Science*, the *Publications* of the Astronomical Society of the Pacific, the *Bulletins* of the United States Geological Survey) since that date. The annual records referred to have been compiled by Messrs. Holden, Keeler and Perrine from observations at Mt. Hamilton, and from miscellaneous reports of earthquake shocks. They have been thoroughly sifted and revised in the present work, which is believed to contain all trustworthy data on the subject of Pacific coast earthquakes since 1769.

In a monograph entitled 'A revision of the American Lemnaceae occurring north of Mexico,' printed in advance from the Ninth Annual Report of the Missouri Botanical Garden, Mr. C. H. Thompson, in continuation of his studies of ligulate Wolffias, published in the Eighth Report, has now brought together, in concise form and with good keys, a synopsis of the entire Order Lemnaceae, as represented in our flora, each species, in addition to a good description, being represented by excellent figures illustrating its habit and structural details. The paper should stimulate increased study of this interesting group of aquatics, the smallest of flowering plants.

We understand that subscriptions toward the purchase of the paleontological collections of the late Professor Cope for the Philadelphia Academy of Natural Sciences are far from reaching the needed sum. A recent issue of the Philadelphia *Ledger* contains an editorial urging the importance of securing these collections. It remarks:

"The public spirit of the citizens of this city should not make it possible for the collections to be taken elsewhere, as they embrace many of the specimens on which Professor Cope based his original descriptions, and this type material is simply priceless, since it cannot be duplicated. If through the liberality of those interested in the progress of science the Academy of Natural Sciences be placed in possession of this material, that institution will then have in its museum the type collections of Leidy and Cope, two of the greatest authorities on the monsters of the pre-historic world."

Simultaneously with the starting of the railroad at Buluwayo, says the New York *Tribune*, comes the news of the discovery of coal in large quantities in the immediate neighborhood of the place, the prospectors having been able to ascertain that the coal fields in question cover an immense area, extending, indeed, to the Zambesi river. It is this discovery, destined to play so great a rôle in the commercial and industrial development of the southern portion of the Dark Continent, that has led Cecil Rhodes to decide to continue the railroad without delay to the Zambesi river, which will then be in uninterrupted railroad communication with the Cape. Apart from their commercial importance the coalfields may contain fossils of great scientific interest.

UNIVERSITY AND EDUCATIONAL NEWS.

A new University was opened at Jassy, Roumania, on November 2d, addresses being made by the king and by the queen of Roumania.

By the will of the late Julia Bradford Huntington James a trust fund left by the late Ralph Huntington was released, and it appears that the Massachusetts Institute of Technology and the Boston Museum of Fine Arts will each receive about $100,000.

The Root Hall of Science and the Benedict Hall of Languages of Hamilton College were dedicated on November 16th. The buildings are both of stone and each cost about $30,000. The Hall of Science is the gift of Mr. Elihu Root, of New York, in memory of his parents, his father having been professor of mathematics in Hamilton College. His brother, Oren Root, now holds the same chair.

Arrangements are being made to build a science hall at Ripon College, costing $30,000. Five subscriptions of $2,500 have already been received.

Rockfeller Hall, the new recitation building given to Vassar College by Mr. John D. Rockfeller, at the cost of $100,000, was dedicated on November 19th. Dr. G. Stanley

Hall, President of Clark University, gave an address on 'A Few Tendencies in College and University Education.'

THE New York *Evening Post* gives the following summary of the attendance at Yale University for the past four years:

	1894.	1895.	1896.	1897.
Graduate	138	176	227	260
Academic	1,150	1,199	1,237	1,242
Scientific	662	584	553	542
Art	41	46	53	77
Divinity	116	105	104	102
Medical	100	125	138	134
Law	195	224	213	194

The decrease in the scientific school is due to the loss of some eighty students who attended under the old land-grant fund régime. The freshmen academic class is the smallest of the five classes this year, whereas there is an increase in the scientific school of 16 students over last year's class.

A CONVENTION of American women propose to assemble in Washington on December 14th to decide on ways and means of arousing public sentiment in favor of a national university. They intend, it is said, to collect the $250,000 necessary for the erection of an administration building, to form the nucleus of the university, and hope to be able to lay the corner stone on February 22, 1899.

THE vacant professorship of pathology at Cambridge University has been filled by the election of Mr. A. A. Kanthack, M.A., of St. John's College, who has acted as deputy for the late Professor Roy. Professor Kanthack, as we learn from the London *Times*, has had a distinguished career at the University of London, where he has taken with honors the degrees of B.A., Bachelor in Surgery, Bachelor in Medicine, was gold medalist, and proceeded to the degree of M.D. in 1892. He has pursued his studies at University College, Liverpool; St. Bartholomew's Hospital, at the Universities of Berlin and Cambridge. His introduction to Cambridge was in 1891, when he was elected to the John Lucas Walter studentship of the value of £200, open to all students for the purpose of conducting original research in pathology. Before that year he had been lecturer in pathology at St. Bartholomew's Hospital, medical tutor at the Royal Infirmary, Liverpool, and senior demonstrator in pathology at University College, Liverpool. He has devoted many years to original research, and was a member of the Leprosy Commission in India. He is the author of a Manual of Practical Morbid Anatomy and of a Handbook of Practical Bacteriology, and also an extensive and frequent contributor to the journals of physiology and anatomy.

DR. THEODORE DES COUDRES has been promoted to an associate professorship of physics in the University at Göttingen and Dr. Otto Knopf to an associate professorship of astronomy in the University at Jena. Dr. Schmitz-Dumond, of Tarand, has been appointed Director of the Agricultural Experiment Station to be established in Pretoria and Dr. A. Ostroumoff to be professor of zoology in the University of Kasan. Professor Küster, of Göttingen, has been appointed head of the division for analytical, inorganic and physical chemistry in the Chemical Institute of the University at Breslau.

DISCUSSION AND CORRESPONDENCE.

THE MESA ENCANTADA.

TO THE EDITOR OF SCIENCE: I thought that I had said the last word as far as I was concerned upon the subject of the Mesa Encantada, but now that Mr. Hodge's pictures have appeared there is one more word to be said. I never dreamed that he or anybody else would have mistaken the manifestly modern and humanly constructed *cairn* which he figures, and about which so much noise has been made, for the *cairn-like* object of which I spoke. The latter is a very different object, and its location gave it some significance, while the former has none of any importance.

The cairn he figures was certainly built by a human being on the 23d of July, 1897, and not by ghosts.

WILLIAM LIBBEY.

PRINCETON, N. J., November 16, 1897.

OBSERVATIONS ON 'THE PRINCIPLE OF IDENTITY.'

THE principle that a thing or relation is identical with itself has given no end of trouble in

discussions respecting experience and knowledge. More than often it has been regarded as an abstract form of self-evident apprehension, whose chief, and perhaps sole, function is to mark the limits of reasoning. How it may have come into our experience has been humorously and seriously debated from Locke downward. It may not be an exact source of knowledge, but this negation does not exclude the peculiar significance attached to *experiencing* the relation in question. The two cases following indicate that there is some meaning to the 'principle' when found in conscious processes at an earlier time.

A bright child, Helen B., four years of age, whose development has been normal in all particulars, perplexed her mother and myself by adding to a conversation, in which she was taking no part and which had no apparent concern for her, these words: "Whatever is alike is the same. If you are good, you have to be good; if you are bad, you have to be bad. Whatever is alike is the same." Tactful questioning failed to bring out any evidence that the utterance was an echo from something the child may have heard. The meaning of the statement seemed to be clear to the child, though able to explain or expand it in no other way. She persisted in the assertion with considerable show of feeling, amounting almost to triumph.

Another and more recent instance is that of a boy in his sixteenth year. In a certain class the teacher was endeavoring to get another pupil to complete the sentence, "A dog is—," for purposes of illustration. After several examples and some hesitation on the part of the second pupil, the first jestingly ventured to supply 'a dog,' the sentence then reading: "A dog is a dog." The teacher accepted the suggestion as 'all right,' and showed how such statements could be made. The boy, however, was confused with astonishment upon learning that his suggestion had passed from jest to earnest, and required a rather long period of time to recover and adapt himself to this relation, which had apparently never occurred to him previously.

These rather opposite cases go to show that the 'principle' is not utterly void when it first arises in the conscious processes, however thoroughly one may claim it to have been operative in primitive mental activities.

Edward F. Buchner.

New York.

SCIENTIFIC LITERATURE.

A Popular Treatise on the Physiology of Plants for the Use of Gardeners, or for Students of Horticulture and Agriculture. By Dr. Paul Sorauer. Translated by F. E. Weiss. London and New York, Longmans, Green & Co. 1895.

One of the excellent features of this book is that there has been a consistent endeavor on the part of author and translator to make it a book clearly within the grasp of the persons for whom it is intended.

The author has succeeded in dealing with many of the problems of nutrition, diffusion, assimilation, etc., in a way that is not only attractive, but can be understood by one who has had little previous training in the study of plants.

After the introduction the author takes up first the structure of the root, and in connection with the structure discusses also the function of the root in the processes of absorption and conduction of nutrient materials. This is followed by a chapter on the nutrition of the root, dealing with the substances in the soil which act as plant food, the effect they have on the plant and the form in which they are taken up by the plant. Practical suggestions are made concerning the best treatment of the soil, the nutrition of pot plants, etc. The treatment of roots in transplanting, in repotting, is also considered.

The structure of the stem and leaf are treated in the same readable way in relation to the functions which they play in the general plant economy. The remaining chapters are devoted to plain directions for pruning, propagating, watering and the general nurture of the plant and seed, from the standpoint of the horticulturist and gardener, and this part of the book, at least to one who deals more with the principles of plant development than with horticultural practice, seems to be admirably done.

George F. Atkinson.

Contributions to the Analysis of the Sensations. By Ernst Mach. Translated by C. M. Williams. Chicago. 1897.

The English-reading public is not a little indebted to the Open Court Company for its rendering into English of some of the best foreign writers of our day. Mr. Williams's careful translation of Mach's 'Analysis of Sensations' is a particularly valuable contribution.

In turning again to a work that has been before the public some twelve years, it will be unnecessary to take up anew the discussion of the particular problems treated. The part played by movement, either actually performed or merely 'willed,' in our perception of space (p. 60, etc.), by the mechanism of attention with its background of continuous bodily processes in our sense of time (p. 111, etc.)—the parts played by these factors have come to be well recognized items in our psychological stock-in-trade. Mach's contributions to the subject remain historically interesting as early, clear and richly illustrated efforts to call attention to these elements in our concepts of space and time. His attempt to reconstruct the psychology of tone, if it has not met with any such general acceptance, presents, nevertheless, a method of treatment that no tone-psychology can afford to pass over without notice. Since the fundamental concepts involved go beyond the special field of audition and serve to illustrate an attitude toward the whole psychology of sensation, reference to them may be left for that connection.

The present review may thus confine itself to a discussion of the points of broader interest for which Mach stands. Such a task in connection with the work before us is rendered pleasant by the author's simplicity of style and limpid clearness of thought. It is rendered difficult, on the other hand, by the desultory plan of treatment that he has consciously adopted. For although we are assured in the original preface that the same problem has been kept in mind throughout, yet to justify such a statement one must consider the problem to be a very general one, indeed.

Mach paves the way to the more technical part of his discussion by sketching in a most skillful manner a view of science in general, of psychology as a particular science, of the problem of sensation as illuminated by these general considerations. It is this part of the discussion that appears to the reviewer to be the central interest of the work. One feels, too, that it lay nearest the heart of the author. It seems, then, to demand rather close attention.

Having swept the decks of such 'metaphysical' concepts as 'things-in-themselves,' science starts with complexes of experience, partly permanent, partly changing (p. 2). Among the relatively permanent complexes are the 'self' and the various groups we call bodies. Their permanence is, however, only relative; the division between them not fixed. The changes to which they are subject furnish an instigation to that analysis by which they are disintegrated into 'elements' (p. 5). These elements, for economic purposes grouped together under single names, separated into not very definite wholes, are, in the end, all alike 'sensations' (pp. 10, 152). Thus 'the world consists only of our sensations' (p. 10).

Starting from this empirical 'monistic' standpoint, it is with the 'connections' of this small number of ultimate elements that science deals (p. 18). The fields of the various sciences are defined, not by the kinds of elements they consider, but by the kinds of connections they take into account. Thus, the ordinary division between mind and body and the separation of sciences dealing with each is, like any other distinction between particular sciences, purely a practical device. "That traditional gulf between the physical and psychical research, accordingly, exists only for the habitual stereotyped method of observation" (p. 14). "There is no rift between the psychical and the physical, no *within* and *without*, no *sensation* to which an outward, different *thing* corresponds. There is but *one kind of elements*, out of which the supposititious within and without is formed—elements that are themselves within and without according to the light in which, for the time being, they are viewed" (p. 151). The same elements, viewed as connected in those groups that we call physical bodies, are objects of study for physics; when one of these physical bodies is regarded as an organism their connection is studied by physiology; when considered as a chain of mental events they offer the subject-matter for psychology (p. 153). Thus, all science is primarily an attempt to reproduce facts in

thought. All that it seems to be more than a detailed account of facts arises from the necessity of performing its function in an economical, even though symbolical, way (p. 154).

The empirical, phenomenalistic standpoint above defined is, perhaps, as satisfactory a basis for scientific development as can at present be formulated. It would, of course, be hasty to regard it as a final formulation. That it contains inherent difficulties must have been as evident to the author as it is to the critic. For example, when it is said 'the world consists only of our sensations' one naturally wonders where the frequently mentioned 'connections' between sensations are to come in. Or, again (the historical stumbling block of 'monism'), what is this experiential, or phenomenal, or sensational character, which, if everything possess it in common, would seem to be as difficult to define as a scholastic 'summum genus'? Finally that 'self' which is a group of sensations, an object of experience, conveniently separated on the basis of certain peculiarities it may possess from other objects, is left in undefined relation to that subject or observer by whom and for whose 'economic' ends the separation is made. Again the historic difficulties surrounding the relation of the self as subject to the self as object!

Nevertheless, it is not probable that any other theory removes these difficulties, although many seem more profoundly conscious of their existence. Their clearness and practicability have made views similar to those of Mach, favorite among scientists (cf. Münsterberg, Karl Pearson, *et al.*). Doubtless more elaborate care expended on the foundation would be out of proportion to the strength of the present scientific superstructure that rests upon it.

From the consideration of these general question Mach turns to his special problem, the psychology of sensation. The ideal of his effort he holds to be the determination of the 'connection of the psychologically observable data with the corresponding physical (physiological) processes' (p. 29). The guiding thread of such a research must be 'the principle of the complete parallelism of the psychical and physical' (p. 30).

It is but a step further to assume as many physico-chemical neural processes as there are distinguishable qualities of sensation (Pref. to Eng. ed.). Similar principles of research are largely admitted and follow naturally from the concepts of Bell and Müller. But the question remains open as to whether different qualities of sensation are to be related to numerically different structures, or whether likeness and difference of mental status are to be related to qualitative likeness and difference of physico-chemical processes taking place in nervous structures whose numerical distinctness, even if existent, is accidental. Mach declares himself for the latter hypothesis, and an illustration is furnished in his treatment of tone-sensations. If, in this field, we look, with Helmholtz, for a special end organ corresponding to each pitch, likeness and difference of tones mean the excitation of the same and of different end organs, a point of much consequence in the theory of harmony. If, on the other hand, we regard the quality of the process that takes place in an end organ as a factor in the result, we might assume with Mach that every end organ is the seat of two kinds of energies (say a 'Dull' and a 'Clear'), the various ratios in which the two are excited being the physiological determinant of the pitch (pp. 128, 143, etc.). Two notes may then be more or less alike, although dependent upon numerically distinct end organs, since each involves the same two specific 'energies,' only in different ratios. Mach is thus enabled to give a physiological basis to that theory of harmony which makes it depend upon the presence of common overtones. All tones are more or less alike; harmonious tones are more alike than others, because their common (physiological) overtones reinforce each other (p. 144, ff.).

The particular tone theory presented by Mach, although highly ingenious, and although it has won for itself some protagonists (*e. g.*, Wundt), becomes a little strained when we try to explain why two simple tones of different pitch are not identical with one tone of intermediate pitch (p. 129). Still the general principle of sense physiology, on which the theory rests, is of the greatest interest. Those who would object that progress in the physiology of the senses has been in the direction of differentiating numerically distinct structures corresponding to

qualitative differences of mental states, must square their antipathy to Mach's theory with the prevailing acquiescence in the view that regards intensity differences as adequately explained by relating them to differences in the energy of excitation of the same physiological structure. It is only a step further to explain differences of quality by relating them to differences in the *ratios* of the energies involved in the excitation, either of the same, or of similar structures. Either our psychology of intensity must be brought into line with the progress of qualitative differentiation or the field must be left open to such theories as that of Mach.

The reviewer agrees with the translator that the matter contained in Mach's little work is by no means so limited as the number of pages. He offers this as an excuse for having passed over many points in the discussion more lightly than their importance deserved.

EDGAR A. SINGER, JR.
UNIVERSITY OF PENNSYLVANIA,
August, 1897.

SOCIETIES AND ACADEMIES.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

OCTOBER 14, 1897.—Mr. Schwarz spoke of the remarkable collection of insects recently made by Mr. H. G. Hubbard in southern Arizona. This collection is the most extensive and valuable which has been made in that part of the country. In Coleoptera alone it contains between 300 and 500 species new to the fauna of the United States. He exhibited a specimen of the myrmecophilous Scarabæid *Lissomelas flohri* Bates, a genus new to the United States and allied to Cremastochilus. The specimens collected by Mr. Hubbard were not found in ants nests, nor could any traces be found of thoracic glands which are supposed to be attractive to ants. The insect fauna of Arizona and southern California was discussed at some length by Messrs. Schwarz, Gill and Fernow. Mr. N. Banks exhibited specimens of *Chrysopa ypsilon*, each of which carried one or more minute Cecidomyiid flies on its wings. The specimens were collected by Mrs. Slosson in the White Mountains, and Mr. Banks considers that the Cecidomyiids use the Chrysopas as a means of locomotion. Mr. Ashmead mentioned a parasitic wingless fly of the family Borboridæ collected by Mr. O. F. Cook in Liberia, which uses a common snail for transportation purposes. Mr. Ashmead described a new genus of Cynipidæ from Liberia which he will call *Currica*, after the collector, Mr. R. P. Currie. It is the only genus of the Cynipidæ with toothed hind femora, and bears a superficial resemblance to certain Chalcididæ. Mr. Howard read a short paper entitled 'Notes on the House-fly,' which gave rise to a discussion on the carrying of contagion by house-flies, in the course of which Mr. D. G. Fairchild described at some length a serious eye disease prevalent in the Fiji Islands, which is carried by the house-fly. Mr. N. Banks read a paper entitled 'A New Species of the Genus *Halarachne*,' the typical specimens of which had been taken from the bronchial passages of a seal which had died in the National Zoological Park. Mr. Ashmead read a paper entitled 'On the Genera of the Xyelinæ.'

November 4, 1897.—Mr. Ashmead showed specimens of the male of *Pelecinus polyturator* from Indiana. The female of this species is very common, but the male is extremely rare. Mr. Ashmead thinks that this insect, the habits of which are not yet known, is probably parasitic upon some Coleopterous wood-borer, a conclusion which was discussed at some length by Messrs Schwarz and P. R. Uhler. Mr. O. F. Cook exhibited specimens of *Peripatus novazealandica* and of two small species of *Peripatus* from the Bismarck Archipelago. Mr. Schwarz exhibited specimens of *Cychrus mexicanus* Bates, a species new to the fauna of the United States, captured by Mr. H. G. Hubbard, at Cave Creek, Arizona. Mr. Howard exhibited specimens of *Trypeta acidusa* Walker, reared from ripe peaches by Mr. A. Koebele, at Orizaba, Mexico, and spoke of the Mexican distribution of *Trypeta ludens*. The subject of the possible establishment of these fruit pests in the United States was discussed by Messrs. Howard and W. G. Johnson. Mr. O. Heidemann read a paper on 'Hemiptera found on the Ox-eye Daisy,' listing twenty-nine species and giving notes on their habits. Mr. O. F. Cook read a paper on 'New Dicellura,' an order which he has erected to include the allies of Japyx. He exhibited plates of ten species and showed specimens of a new

African form which he thinks will form a new family in which the forceps are replaced by stylets. Dr. H. G. Dyar read a paper on 'Some Structural Points in Saw-fly Larvæ.' Mr. N. Banks presented a paper on an 'American Species of the Genus *Cæculus*,' a genus new to the United States and previously known only in Europe. Professor P. R. Uhler exhibited a series of American Notonectas and spoke of the distribution and structural peculiarities of the genus. As a result of the recent studies of Mr. G. W. Kirkaldy nine valid species are now known from the United States.

L. O. Howard,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON—281ST MEETING, SATURDAY, NOVEMBER

Professor Lester F. Ward exhibited specimens of *Prosopis juliflora* from Kansas, a species not previously found in the region of Gray's Manual; also of *Psoralea tenuiflora*, remarkable as a tumble-weed, and of *Lotus americanus*, a peculiar 'compass-plant.'

Mr. E. L. Morris showed some alcohol specimens of various vertebrates and invertebrates illustrating methods of sectioning to show the alimentary canal.

Mr. Charles L. Pollard presented 'A Publication Problem in Botany,' drawn from Rafinesque's Florula Ludoviciana. This book was practically compiled from the list of plants given by a Frenchman, Robin, who had traveled extensively in Louisiana, and had made numerous field observations and descriptions. Rafinesque based many of his new genera and species on these field notes, never having seen any type material, and Mr. Pollard asked for an expression of opinion on the tenability of these names, explaining that botanists of the present day are divided on the question. The consensus of opinion in the Society, elicited by discussion, favored the retention of the names in all cases where they were identifiable.

Dr. M. G. Motter presented a paper on 'Underground Zoology,' being the result of a careful examination of a large number of disinterred human bodies with a view to ascertain the species of animals and particularly of insects that might be present in order to test Mégnin's 'Application of Entomology to Legal Medicine.' Some 75 species belonging to 60 genera were noted and the conclusion drawn that so far as the evidence of his observations was concerned the medico-legal aspect of cadaverine entomology was enveloped in a haze of uncertainty, not to say doubt.

Mr. F. A. Lucas spoke of the 'Fossil Bison of North America,' saying that while remains were widely scattered over the United States the species were known mostly from horn cores, and owing to lack of correlation of these with other parts they could not be satisfactorily diagnosed. He recognized six species besides *Bison bison*, viz.: *Bison alleni, antiquus, crassicornis, ferox, latifrons* and *scaphoceras*. *B. crassicornis* of Richardson, which had been confounded with various species, was perfectly distinct, while *B. crampianus* was probably synonymous with *B. alleni*.

Dr. C. Hart Merriam described the 'Life-zones of the Olympic Mountains,' noting the flora and fauna of the region at some length. But two zones were distinguishable, a Hudsonian and a mixed Transition and Canadian.

F. A. Lucas,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the 67th regular meeting of this Society, the first meeting of the course of 1897–98, held in Washington, D. C., on November 10, 1897, Mr. Lester F. Ward read a paper on the Cretaceous Formation in Southwestern Kansas. Mr. Ward had made a study of the Cheyenne formation, as well as of all the Cretaceous deposits in that region lying between the Red Beds and the Tertiary.

The principal section lay along the Medicine Lodge River, extending from a point near Sun City, in Barber county, to Fullington's ranch, near the extreme head of that stream, in Kiowa county. The center of operations was at Belvidere, and all of the most typical exposures of the Cheyenne occur within a radius of ten miles from that point. A reconnaissance was also made to the southwest as far as the Avilla Hill, five miles south of the town of Avilla, in Comanche county, and thence northwestward to Mt. Nebo, St. Jacob's Well, the Big Basin,

and the various draws and breaks on Little Sandy creek, Chatman creek, Bear creek, Bluff creek and Hackberry creek, where the Cretaceous formation, is extensively exposed. The following is a brief summary of the general results:

The Cheyenne formation rests everywhere unconformably upon the Red Beds, occasionally with a gravel bed at its base. It is a good geological unit, clearly marked off from the overlying Kiowa, the lowest member of which forms a thin ledge of marine shells, the Champion of Cragin. The lower part of the Cheyenne is almost always a massive sandstone, often cross-bedded, pure white, or more frequently stained yellowish. It contains no admixture of clay, but occasional thin clay shales, and very rarely more or less lignite. Near its base silicified wood occurs, at some points in considerable abundance. This bed, No. 1 of Hill, the 'Coral Sandstone' of Cragin, varies greatly in thickness, but where well preserved reaches 50 feet. In typical exposures this is overlain by some 15 feet of carbonaceous shales, consisting largely of dark, sandy, stratified clays, much lignite, and abundant vegetable remains, usually matted and confused so as to yield few determinable impressions. This is the No. 2 of Hill's section, the 'Lamphier Shales' of Cragin. Above this is the 'Stokes Sandstone' of Cragin, Hill's No. 3, having a thickness of some ten feet and consisting of stratified sandstone of a somewhat darkish or grayish color, considerably argillaceous and carbonaceous and often holding plant impressions. The character and relations of these upper beds, however, were found to vary so extensively that this subdivision has very little value. A large collection of fossil plants, amounting to 44 boxes, with an aggregate weight of about 3,000 pounds, was made in these upper beds and has been received at the U. S. Geological Survey.

The Cheyenne is confined exclusively to what may be called the Belvidere region, chiefly along Medicine Lodge river, as above noted, but passing southward along the head of Elk creek, across Mule creek and Indian creek, some six miles southeast of Nescatunga, forming a sort of crescent. It does not occur in the Avilla Hill nor anywhere in Clark county, so far as Mr. Ward was able to observe; the rocks of the former region, supposed by Prosser to represent the Cheyenne, being wholly different and belonging to the lower Kiowa beds, underlain by black papyraceous shales; and the Big Basin Sandstone, which Prosser also referred to the Cheyenne, being clearly, as Cragin states, nothing but the upper indurated portion of the Red Beds, the top of which is almost always whitened.

Perhaps the most important result of this expedition was the discovery of the true base of the Dakota group in a series of remarkable beds, nearly 200 feet in thickness and not hitherto described, forming an uninterrupted transition from the Kiowa Shales, holding Gryphæa and Exogyra, to the typical Dakota Sandstone, yielding characteristic dicotyledonous leaves, a small collection of which was made. Mr. C. N. Gould, who was a member of Mr. Ward's party, and who had previously seen most of these deposits, will soon publish a paper setting forth their relations in detail.

Under the title 'The Geological Sequence in Jamaica,' Mr. Robert T. Hill presented an account of the stratigraphic succession in Jamaica, describing the various rocks of igneous, sedimentary, oceanic and organic origin and their relations. Mr. Hill's paper was an extract from his report to Professor A. Agassiz, under whose auspices the studies were made. In discussing the elevated coral reefs he stated that there can be no possible doubt but that they were formed around emerging land, as held by Agassiz.

W. F. MORSELL.

U. S. GEOLOGICAL SURVEY.

NEW YORK ACADEMY OF SCIENCES—SECTION OF GEOLOGY—NOVEMBER 15, 1897.

THE first paper of the evening was by Dr. F. J. H. Merrill, of the State Museum at Albany, entitled 'Geology of the Vicinity of Greater New York.' Dr. Merrill considered the distribution, relations and structure of the Crystalline, Metamorphic and Intrusive rocks east of the Hudson. He noted particularly in the vicinity of New York City the Pre-Cambrian Fordham Gneiss, overlain at certain places, as

at Lowerre, Hastings, Sparta and Peekskill, by a very thin bed of Quartzite, probably representing the Georgian Quartzite of Dutchess county. Above this is a thick series of Crystalline Limestones, forming the river valleys of the Harlem, Bronx and other rivers, and underlying most of the navigable water ways in the vicinity of New York. The upper rocks are Mica-schists, which are probably of Hudson River age, and make most of the highlands of New York City and vicinity. These rocks are extensively folded in a general direction of N. 40° E., with occasional cross foldings, producing the cross valleys. The whole series is crossed by the Manhattanville Fault, running from Manhattanville, North River, southeastwards to the East River, between Ward's and Blackwell's Islands, into Astoria Bay. The fault, along which there has been a throw of a number of hundred feet, was long ago described by Professor Dana.

The second paper of the evening was by Captain J. J. Riley, entitled 'The Guano Deposits of the Islands of the Southern Pacific, and their Prehistoric Remains.' Capt. Riley considered in detail the depth, value and manner of working of the guano deposits in the Chincha Islands, off the southern coast of Peru, from which guano was first taken by Humboldt in 1804, and which have since been very famous for their guano deposits. Between 1850 and 1880 it is estimated that guano to the value of $550,000,000 in gold was taken from three islands alone. The islands lie in the rainless region, and the preservation of the guano is due to the absence of water. Once in about seven years there is a season of quite a little rainfall, which has undoubtedly a great effect upon the guano, and was considered by Captain Riley to be the cause of the blacker bands in the layered deposits. Two burial tombs containing bodies of great antiquity have been discovered in the guano. The bodies were evidently those of royal personages, and apparently, from the evidence of slabs containing certain symbols, related to the Incas. These tombs were found at a depth of 35 and 68 feet, but it is not possible to state whether they were buried in the guano or later covered by it. The islands, three in number, are granitic in character, and were covered by a varying thickness of guano, reaching in the more important island a depth of 203 feet in places. The exportation of guano has, however, ceased since 1880.

In the discussion Dr. Julien compared these islands with other guano-bearing islands of the West Indies, paying particular attention to the absence of any evidences of human remains showing life coincident with the formation of the guano.

The third paper, read by title, was by Mr. Stuart Weller, and entitled 'A New Crinoid from the Coal Measures of Kansas.'

Richard E. Dodge.
Secretary.

BOSTON SOCIETY OF NATURAL HISTORY.

The first general meeting of the season was held November 3d, seventy-five persons present.

Mr. J. B. Woodworth spoke of Mr. Saville-Kent's work concerning the Great Barrier Coral Reef of Australia. He sketched briefly the chief results of the studies of Darwin and others upon the theory of coral reefs and showed a series of lantern slides giving a general view of the life upon the Great Barrier Reef. This reef stretches along the coast for a distance of more that 1,200 miles; the distance from the outer edge of the reef to the mainland varies from 10 to over 100 miles. The reef and adjacent waters abound in Nullipores, Madrepores, Alcyonarians, Holothurians, etc. The pearl and pearl-shell, Trepang and oyster fisheries are of very great importance.

Samuel Henshaw,
Secretary.

NEW BOOKS.

Bau und Leben unserer Waldbäume. M. Büsgen. Jena, Gustav Fischer. 1892. Pp. viii+230.

Handbuch der Klimatologie. Julius Haun. Stuttgart, J. Engelhorn. 1897. 2d edition, revised and enlarged. Vol. I., pp. xii+404; Vol. II., pp. viii+384; Vol. III., pp. viii+576.

Essai sur les conditions et les limites de la certitude logique. G. Mulhaud. Paris, Alcan. 1898. 2d edition. Pp. viii+202. 2 fr. 50.